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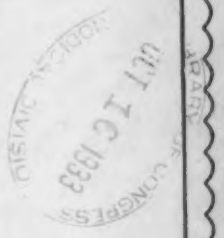

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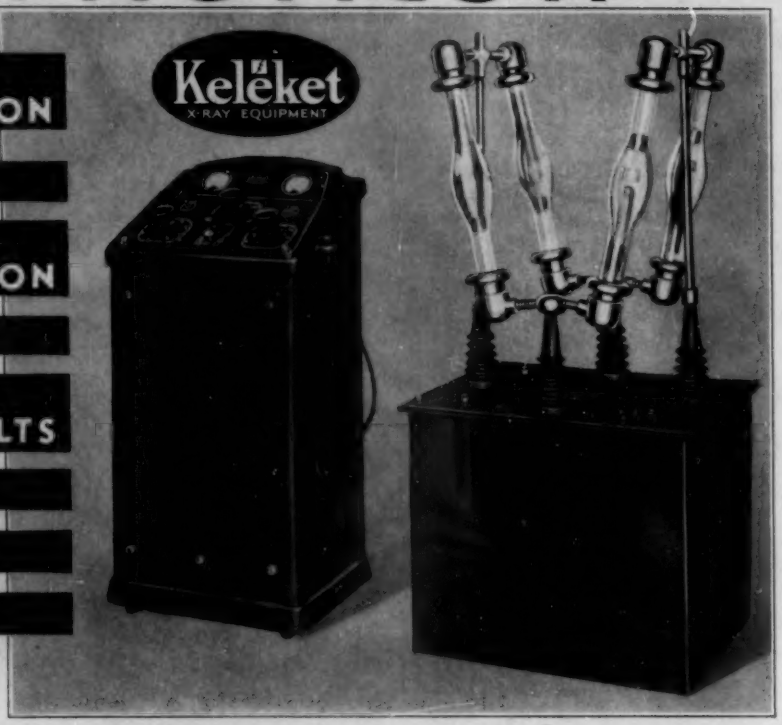

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THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

VOL. XXX JULY, 1933 No. 1

KIENBÖCK'S DISEASE OF THE SEMILUNAR BONE OF THE WRIST*

By CARL L. GILLIES, M.D.
CEDAR RAPIDS, IOWA

KIENBÖCK in 1910 called attention to an isolated degenerative disease of the semilunar bone of the wrist, which presented a rather constant clinical picture and typical roentgen findings. He observed that while a history of severe injury to the wrist may be present, it does not seem to be essential, and the condition may follow an injury so slight as to have been forgotten, or one in which the immediate symptoms are not severe enough to prevent the patient from working.

Kienböck's observations were based on 20 cases collected from the literature, which had been reported either as compression fractures or accessory bones in the region of the semilunar, and 16 personally observed cases which he discussed from the standpoint of the roentgenologist.

Oddly enough, although the later stages of Kienböck's disease have a very characteristic and typical roentgen picture and, in fact, the preoperative diagnosis can only be positively made by roentgen examination, I am unable to find an original article on Kienböck's disease in any of the leading American journals devoted to our specialty. Although he reported no cases, first mention of Kienböck's disease in the English literature was made by Speed in his textbook published in 1916. Since that time I have been able to find but 23 reported cases in this country. Fifteen have been reported in England and 2 in Canada. To these I wish to add 5 of my own. It is generally agreed, however, that the condition is more common than the reported cases lead one to believe.

Aside from the term, "Kienböck's disease," the names applied to the condition are almost as numerous as the essayists reporting cases and in part are as follows:

Secondary post-traumatic malacia
Lunate osteomalacia
Traumatic atrophy
Traumatic nutritional disturbance
Traumatic osteoporosis
Traumatic osteitis
Chronic osteitis
Aseptic necrosis
Compression osteitis, etc.

Because the disease is not understood, the theories as to etiology are also numerous. They have been summarized by Riches as follows:

(a) *Those assuming the presence of a fracture.*—
1. Localized osteitis fibrosa in the region of a fracture (Wollenberg).
2. Defective regenerative ability of the carpus (Baum).
3. Aseptic primary bone necrosis with a pathological fracture (Axhausen).

* Read at the Thirty-third Annual Meeting, American Roentgen Ray Society, Detroit, Mich., Sept. 27–30, 1932.

(b) *With no assumption of fracture.*—

4. Injury to the blood-vessels, due to tearing of the dorsal and lateral ligaments following a momentary dislocation, and followed by rarefaction (Preiser). That this is probably incorrect was pointed out by Ogilvie when showing a case recently at the Medical Society of London. He had followed up cases of dislocated semilunar which were reduced, and none had developed Kienböck's disease.
5. Abnormal pressure due to anatomical anomalies (Müller).
6. Degeneration (Destot).
7. Infection (Fontaine).
8. Leriche assumes that there can be no rarefaction without hyperaemia, and suggests a traumatic axone reflex, the sequence being trauma, vaso-constriction vaso-dilatation, bone absorption.

Kienböck believed that any compression of the bone was not primary, but was secondary to a degeneration and increased fragility resulting from an injury to blood vessels during a momentary subluxation, a theory applied previously by Preiser to similar changes occurring in the carpal scaphoid, and comparable to changes found in Kümmell's disease of the spine. Others have thought the condition comparable to the osteochondritides such as Perthes', Legg-Calvé's, Köhler's, Osgood-Schlatter's, etc. Against this belief is the fact that Kienböck's disease has always been found in adults, whereas the other group occurs in childhood or at least before the closure of the epiphyses.

INCIDENCE

In 45 cases which comprise the 25 reported North American, 15 English, and the 5 of my own, 37 occurred in males and 8 in females, a predominance in males of slightly over 4.5 to 1. The right wrist was involved 27 times to 11 times on the left. One case was bilateral, and in 6 cases the wrist involved was not stated, a predominance of involvement of the right wrist of nearly 2.5 to 1.

The age incidence varied from eighteen to sixty, approximately one-half occurring between the ages of twenty to thirty, and three-fourths between the ages of twenty to thirty-five. Almost every case occurred in a person engaged in heavy manual labor.

PHYSICAL FINDINGS

Physical examination reveals in every case varying degrees of limitation of wrist motion in all directions. In the active stages of the disease, there is pain on movement, particularly on twisting or pushing. Swelling is usually present over both the dorsal and ventral surfaces of the wrist with tenderness to pressure over the semilunar bone. Finister (quoted from Goldsmith) states that two signs, if present, are almost pathognomonic. These are:

1. The head of the third metacarpal is on the same level as those of the second and fourth, while normally it is more prominent. This is, of course, due to partial absorption of the semilunar, allowing the third metacarpal to be retracted.
2. Pain localized over the semilunar bone on tapping the head of the third metacarpal with the fist closed and the hand in ulnar adduction.

ROENTGEN FINDINGS

The roentgen findings, after the development of the characteristic bony changes, offer the simplest method of positive diagnosis. Films of the affected wrist show an increase in density of the semilunar with loss of the normal bony trabeculations. Small wavy lines of rarefaction running in a transverse direction are usually present producing the appearance of fragmentation. The proximal articular surface is irregular and deformed, whereas the distal surface is smooth and of normal shape.

The lateral view is very important, and shows, in addition to the increase in density, a change in the contour of the bone. The normal crescentic shape is lost, the superior and inferior surfaces being more nearly parallel, with a resulting loss of volume. The roentgen findings are unchanged years afterward. The appearance of the bone seems to bear no relation to the patient's subjective symptoms.

It is said that films taken immediately after the onset of symptoms may show no demonstrable roentgen changes, but in those cases which develop following a history of adequate trauma, fracture lines may sometimes be seen. Unfortunately, as in all of my cases, the taking of roentgenograms is likely to be delayed, due either to the mildness of early symptoms or the lack of objective findings, which often leads the attending physician to suspect malingering.

TREATMENT

Of the 40 cases reported in England and America, slightly over half have been operated upon. In this group the first operations were reported by Rogers in 1921 and 1922. The results of complete excision of the bone appear to be satisfactory. Although some limitation of motion is almost sure to result, pain is relieved and a good functional wrist is usually obtained, the patient being able to resume heavy work in a comparatively short time. Early operation also lessens the possibility of the development of a traumatic arthritis.

Under non-operative treatment consisting of splinting, etc., in only 4 cases (Undine, Riches, and in Cases III and IV of this series) has there been almost complete functional recovery, and except for Case III only after several years of disability. As most of the cases have not been followed for this long or the ultimate results have not been reported, it is reasonable to expect a somewhat larger percentage of symptomatic recoveries.

When one considers the number of failures following a long period of expectant treatment, in a class of people depending upon the use of their hands for a livelihood, it would appear that early operation is the treatment of choice.

PATHOLOGY

Several specimens removed at operation have been examined microscopically. A typical report reads as follows:

"Microscopic sections of the lunatum showed central necrosis and breaking down of bone by fibroblastic tissue with considerable absorption of cartilage. There was practically no leukocytic infiltration. In some regions there was extensive regeneration of bone and cartilage. The process of transformation was one of absorption and replacement of the dead bone by fibroblastic tissue which in turn was being replaced by new fibroblastic tissue, which in turn was being replaced by new bone formed from surviving old bone rather than one of creeping substitution of dead bone by new as occurs extensively in the organization of areas of aseptic necrosis." (Phemister, et al.)

Fig. 1. Case 1. Sclerosis and irregular outline of semilunar bone.

INDUSTRIAL AND MEDICOLEGAL ASPECT

Since Kienböck's disease occurs almost always in persons engaged in heavy manual labor, the medicolegal aspect and the question of compensation are important. A large share of the responsibility of determining the duration of the disease rests in the hands of the roentgenologist, whose opinion must be based upon the amount and character of the bony changes present. A pitfall to be avoided is assuming that a recent injury has been solely responsible for the production of the disease, whereas actually it may have been pre-existing, and the recent injury has only served to aggravate the symptoms or focus attention on an already damaged wrist.

While in a certain number of cases no

history of adequate trauma can be obtained, trauma undoubtedly plays a very important part in its production. In about

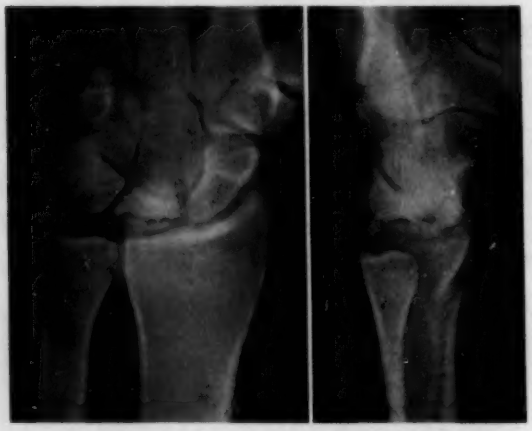

Fig. 2. Case II. Sclerosis, wavy transverse lines of lessened density, and loss of volume of semilunar bone.

one-third of the 45 cases reviewed, a history is recorded of the onset of symptoms following a single acute dorsiflexion injury to the wrist. Others give a history of onset following a blow to the back of the wrist or directly on the closed fist, the force being transmitted through the metacarpals. My personal views are in general accord with those of Müller (quoted from Köhler), who lays the blame on compression injuries.

"Three forms are said to occur:

(1) In the anatomically conditioned forms a pathological process of the semilunar is brought about by the special and abnormal anatomical conditions."

Obviously this group has no relation to the type of occupation, and should not be compensated.

(2) "In the 'professional' forms continual small compression injuries in special occupations (especially agriculture) are blamed as the cause."

It would appear that the repeated minimal trauma is the direct result of the character of the occupation, and, therefore, this group is entitled to compensation.

(3) "In the traumatic form a single compression injury can elicit the disease. The latter runs its course in three stages and this is pathognomonic: first a short stage of slight articular irritation, then a stage of relative absence of symptoms, several months in length, finally a definite stage of disease with severe manifestations."

This type seems to offer the least difficulty in determining the responsibility of the employer, and if the injury occurred during the course of duty, the patient is deserving of compensation.

The infectious theory as a causative factor cannot be ignored. One group of observers (Phemister et al.) in a controlled experiment, under very strict aseptic precautions, were able to grow long chain streptococci in 2 instances in which the semilunar bone was removed by operation.

In the following 5 cases of my own, the histories were obtained from the patients at the time of their second roentgen examination, which in most instances was several years after the onset of symptoms. For that reason the time as recorded between the onset of symptoms and the taking of the first roentgenograms may not be accurate.

Fig. 3. Case II. Four years later, showing little change in appearance.

Case I. E. M., male, aged twenty-one, baker.

On January 3, 1930, the patient was struck on the back of the right wrist with the dump

crank of a dough mixer. Although the wrist was painful, he continued working, and a doctor was not consulted for two weeks. At this time malingering was at first suspected because of the absence of objective findings. On January 24, 1930, a roentgenogram (Fig. 1) was made which shows a loss of normal bony trabeculations, an increase in density, and an irregularity in the outline of the semilunar. This irregularity is seen best in the lateral view.

The wrist was immobilized in plaster-of-Paris with only temporary relief. When last seen by the attending physician on May 21, 1932 (two years after the original injury), there was still limitation of motion with pain in the extremes of motion, and tenderness to pressure over the semilunar.

Case II. N. L. M., male, aged twenty-five, laborer.

In 1928 a truck that the patient was cranking, backfired, injuring his right wrist which remained "lame" for three weeks. About two weeks later the wrist was again injured in the same way.

A roentgenogram (Fig. 2) taken at this time shows a sclerosis and loss of volume of the semilunar with transverse wavy lines of lessened density in the proximal half of the bone.

Fig. 4. Case III. Sclerosis, irregular areas of lessened density and loss of volume of semilunar bone. The deformity of both bones of forearm and shortening of ulna with fracture of styloid process are the result of an old injury.

The patient was seen again in July, 1932 (four years later), and a film (Fig. 3) shows very little change in the appearance of the semilunar.

Examination shows limitation of wrist motion in all directions with pain in the extremes. There is tenderness over the semilunar

Fig. 5. Case III. Two and one-half years later, showing little change in appearance. There is no history of disability.

on pressure. The patient says he is able to lift heavy objects, but any twisting of the wrist causes sharp pain followed by a dull ache in the wrist.

The wrist has been splinted many times with but temporary relief. The patient is unable to do ordinary labor because of his wrist, and has lost his job as a consequence.

Case III. R. W. W., male, aged forty-two, locomotive engineer.

A routine physical examination on October 27, 1929, showed a slight limitation of motion of the right wrist in all directions. There were no subjective symptoms and the patient was unaware that there was anything wrong. He gave a history of having fractured both bones of the right forearm at the age of ten.

A roentgenogram (Fig. 4) shows anterior bowing of the radius, posterior bowing and shortening of the ulna, obviously a result of the childhood injury. There is an old fracture of the styloid process of the ulna, and the semilunar shows general sclerosis with small irregular areas of rarefaction and a loss of volume.

A film (Fig. 5) made in July, 1932 ($2\frac{1}{2}$ years later), shows no change in appearance.

I believe this case falls into the anatomical conditioned group, and is similar to one shown by Müller. Both show shortening of

Fig. 6. Case iv. Sclerosis, loss of volume and wavy transverse lines of lessened density of the semilunar bone.

Fig. 8. Case v. Increase in density, loss of volume and flattening of the proximal surface of the semilunar bone.

the ulna allowing additional stress and strain to fall on the semilunar.

Case iv. Male, aged thirty, laborer.

In the latter part of 1923, the patient slipped and fell forward, striking the open palm of the right hand on the ground. He immediately experienced pain in the wrist, but was able to continue work. The wrist was kept bandaged for several weeks with but little improvement.

A roentgen examination (Fig. 6) on December 17, 1923, shows loss of volume of the semilunar, sclerosis and transverse wavy lines through the proximal half of the bone. No further treatment was given. The wrist was subject to twinges of pain for four or five years, but for the last four or five years has been entirely free from pain.

A film (Fig. 7) made in June, 1932, or nearly nine years later, shows an increase in the sclerosis, but no change in size. Examination of the wrist shows slight limitation of motion in all directions but no subjective symptoms.

Case v. U. V. R., male, aged twenty-eight, laborer.

The patient gives a history of having sprained his right wrist many times previously, but always with complete recovery. He dates the onset of the present symptoms to a twisting injury to his right wrist sustained while lifting a one hundred pound sack. The symptoms did

Fig. 7. Case iv. Nine years later shows an increase in density of the bone.

Fig. 9. Case v. One month later. Shows in addition a vertical fissure seen in the lateral view.

not improve so he consulted his doctor three weeks later, on August 6, 1932.

Examination at this time showed limitation and pain in the extremes of motion with tenderness over the semilunar to pressure. A roentgenogram (Fig. 8) shows a moderate increase in density, loss of volume and flattening of the superior surface of the semilunar.

The patient was seen as recently as September 5, 1932. There has been no improvement of symptoms. He is still working and is able to lift, but twisting and lateral pressure cause severe pain. His duties include the signing of receipts, several carbon copies being made at one time. He is unable to do this because of pain from lateral pressure.

A film (Fig. 9) at this time shows very little change in appearance from the film of one month ago.*

* For discussion see page 49.

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TRAUMA AS AN ETIOLOGICAL FACTOR IN THE PRODUCTION OF DISEASES OF THE CHEST*

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IN THIS day of intensive industrial activity all types of injury have assumed great importance. The respiratory system is a complicated apparatus which carries with it the hazard of many other complications not associated with injuries in other regions of the body. The large serous-lined pleural cavity offers hazard of infection if it is penetrated from without; the normal negative pressure in the pleural cavity essential to respiration can easily be lost by penetration of the chest wall from without or puncture of the lung from within; the lung itself, an elastic body expanding and contracting with each respiratory cycle, is filled with numerous bronchioles and air sacs, yet is separated from the pleural cavity only by a thin delicate pleural membrane which can be easily ruptured, and, above all, the respiratory function, which is dependent on so complicated an apparatus, is essential to life. All of these things conspire to give injuries to the chest an importance which other injuries do not possess.

Injuries to the chest may be properly considered under the following headings:

(1) Effects caused by trauma from without—external violence.
  (a) Contusions of the chest wall.
  (b) Fractures of the bony framework.
  (c) Penetrating wounds of chest—stab wounds and gunshot wounds.
(2) Effects produced by trauma from within—internal injury.
  (a) Changes in intrathoracic pressure—rupture of lung with spontaneous pneumothorax.
  (b) Aspiration of foreign bodies—laceration of lung structure; bronchial occlusion.
  (c) Instrumentation, bronchoscopy.
(3) Trauma as a factor in the production of bacterial diseases of the lungs and pleurae.

The most common effect of trauma applied to the chest is contusion of the chest wall and fractures of the bony framework, especially of the ribs. Ordinarily contusions of the chest wall cause no damage to the respiratory organs whatever, but occasionally pneumothorax may result with accompanying collapse of the lung. This may occur without even a mark being left on the chest wall. Where a rib is fractured and the lung punctured, this is easy to understand, but where pneumothorax occurs without fracture of the ribs it is more difficult to explain. Several such cases have been noted where an automobile has passed over the chest of an individual causing pneumothorax without fracture of the ribs or any evidence of trauma to the chest wall. A rather extreme example of pneumothorax without attendant fracture of the ribs was noted in a patient who in suicidal attempt jumped from the St. Louis Municipal Bridge and struck the water surface 125 feet below, flat on his left side. There were no fractured bones, but he suffered pneumothorax on the left side with complete collapse of the lung; ecchymosis of the entire left side of the body was present. A second person who some months later jumped from the same bridge suffered similar injury. If pneumothorax occurs from such a type of injury it occurs immediately and the collapsed condition of the lung can be demonstrated at once. In such cases the lung soon heals and the air is rapidly absorbed; complete recovery usually results within three or four weeks. Unilateral pneumothorax is not so serious; bilateral pneumothorax, however, is very serious and may result in death.

Dry pleurisy with thickening of the parietal pleura over the injured area may result from trauma applied to the chest

* From the Radiology Department of St. Mary's Hospital and St. Louis City Hospital. Read at the Thirty-third Annual Meeting, American Roentgen Ray Society, Detroit, Mich., Sept. 27–30, 1932.

wall, either with or without fracture of the ribs. In such instances unattended by fracture of ribs the symptoms often are not pronounced until three or four days or a week after injury, when a sharp knife-like pain develops in the involved area on deep inspiration. The area involved is usually limited to the region of trauma. We have never had in our experience any instance in which this type of pleurisy did not subside with proper strapping within a few days or weeks without subsequent ill effect. Pleural effusion rarely supervenes and we have never seen empyema develop from external trauma where the chest wall has not been penetrated. Roentgenographically a localized thickening of the pleura can be noted over the area involved; the appearance is not in any respect different from thickening of the pleura from other cause.

Free hemorrhage into the pleural cavity usually does not occur unless there has been actual fracture of a rib or penetration of the chest wall by some instrument. Blood does not seem to have the same tendency to clot in the pleural cavity that it ordinarily possesses elsewhere in the body, and bleeding may continue for a long time. Clotting of blood in the chest does occur, but it is often delayed and bleeding may continue for days. The roentgenographic manifestations of hemothorax are in most respects similar to those seen in other types of fluid; occasionally where there is no associated pneumothorax, however, the appearance immediately after the injury may be that of a general haziness over the entire chest rather than an increase in density possessing the characteristic upper curved line of fluid. This is probably due to the fact that in the early stages the blood has spread itself out in a thin layer between the lung and chest wall. It is not sufficient, therefore, if no manifestation of pleural hemorrhage is noted at roentgenographic examination immediately after injury, to conclude that the danger from this cause can be eliminated; subsequent roentgenographic examinations must be made. Fluid blood remaining in the chest for a long time undergoes chemical changes and becomes a dark chocolate color. These chemical changes release protein substances which in their new forms are foreign to the body and provoke a sensitization reaction. Continuous high fever for a period of days or weeks

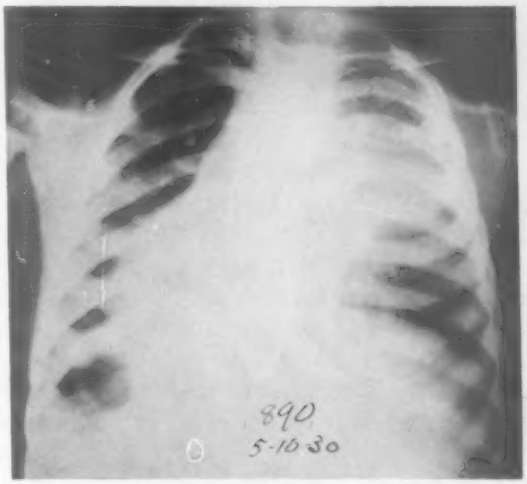

Fig. 1. Traumatic pneumonia in child following five days after fall from highchair. The site of consolidation in right side is over the site of injury. There was no contusion or laceration visible on the chest.

may lead to the belief that infection has occurred, whereas the fever may only be due to the sensitization reaction. Under these circumstances aspiration of the fluid will terminate the fever and result in complete recovery. We have not seen in our experience any lasting or disabling results following hemothorax where infection was not present.

Hemorrhage into the surrounding interstitial tissues of the lung from injury to this organ is a frequent occurrence, especially where the injury is extensive and there are multiple fractured ribs. The roentgenographic appearance is one of a blotchy irregular area of increased density without well-defined margins, usually involving the lower lung fields. This may be associated with hemoptysis, dyspnea and pain in the chest. The patient is usually in extreme shock. These roentgenographic

findings are usually present immediately following severe injuries. They may be attended by bleeding into the free pleural cavity. This condition is rarely associated with pneumothorax and if the patient recovers from the immediate shock, resolution most frequently takes place with complete restoration to normal, often without producing ill effect or without leaving any manifestation in the roentgenogram after recovery. Where interstitial hemorrhage occurs as a result of penetrating wounds such as stab wounds, gun shot wounds, etc., the characteristic appearance may not be shown at once, but may require a few hours to develop.

Ordinarily, penetrating wounds of the chest cannot be considered as extremely serious if infection does not supervene. In an analysis made a few years ago at St. Louis City Hospital[7] of stab wounds and gunshot wounds of the chest it was found that in a series of 135 cases of gunshot wounds treated at the Hospital during a five-year period, 58 proved fatal, largely because of associated injury to the abdomen, skull or spinal cord. Only 4 of the fatal cases were from lung involvement alone, and in all of these the wound was in the upper chest, or traversed both lungs from side to side. In the first patient the wound was located in the episternal notch; in the second, it was through the sternoclavicular joint; in the third, the wound was in the upper lobe, and in the fourth, the wound was in the axilla, traversing the chest from side to side. It is probable that these cases were attended with mediastinal involvement, since vomiting of blood was a prominent symptom. If one lung alone is involved, and the injury is not extensive, recovery can be expected in a large percentage of cases.

In a series of 108 stab wounds of the chest treated at the St. Louis City Hospital during the same five-year period, 11 proved fatal. Death in these instances likewise was due to associated injury to other organs, especially the heart and abdominal organs. One instance occurred in which death was probably due to hemorrhage from an intercostal artery, since no evidence of injury to the lung could be found at autopsy. When a stab wound is confined to the lung and is unassociated with injury to the heart or abdominal organs, recovery can be expected in a very large percentage of instances. When recovery occurs, it is usually complete and healing takes place with little if any disability. There is usually no demonstrable sign in the roentgenogram.

From an analysis of this series of cases it was also found that there is very little likelihood of infection being carried into the chest by injuries from without, even where there has been complete penetration of the chest wall with injury to the pleura and lung, "since in only three instances in a total of 174 patients who survived, following penetrating gunshot wounds and stab wounds of the chest, did empyema subsequently develop; once following a gunshot wound and twice following stab wounds."

If infection of the lung does occur the resulting abscess has the characteristic appearance of abscess from other cause and carries with it the same grave prognosis as to life and ultimate recovery of function. We have seen only a few instances in which abscess of the lung was caused by trauma from without; these were due to direct inoculation of infection by penetrating wounds and never to trauma, even when extreme, in which the chest wall was not penetrated. In only one condition does bacterial disease of the lungs seem to follow trauma in a few instances; this is in so-called "traumatic pneumonia" which will be discussed more fully later.

One rather peculiar condition of doubtful etiology which follows trauma to the chest and even remote portions of the body is massive atelectasis. This is a condition in which the lung, previously well expanded and functioning normally, suddenly, without apparent cause, loses its air content and becomes atelectatic. The loss of air content causes the lung to become smaller

than when previously expanded and, since there is no attendant pneumothorax, the side of the chest affected becomes narrower —the interspaces show closer approximation; the heart and mediastinal structures are drawn over to the affected side and the diaphragm becomes elevated and immobile on the affected side. The collapsed lung shows a density fully as great as pneumonic consolidation. This condition may follow direct injury to the chest or other remote portions of the body. It is most frequently encountered as a postoperative complication after abdominal operation. The condition is disabling for a time, but is rarely fatal and on re-expansion of the lung, complete function is reestablished without any subsequent ill effects.

Trauma from within is more limited in its variety of effects. Obviously any effect which changes the intrathoracic pressure will place a strain on the lung. This can cause rupture with spontaneous pneumothorax and collapse of the lung. Heavy straining or lifting may produce this condition in a lung which shows no evidence of previously existing disease. At times this follows seemingly trivial exertion; it may be accompanied by sudden pain in the chest and shoulder extending down the arm; there may be accompanying dyspnea if the collapse is pronounced. With rest, the lung heals and the air is absorbed by the circulating blood. We have seen a number of instances in which pneumothorax of this type recurred at intervals without apparent pulmonary disease. The condition is probably due to rupture of an emphysematous pleural bleb. A period of absolute bed rest for one month has resulted in complete healing and restoration to normal.

Fig. 2*a*. Left shoulder of boy taken shortly after falling down. No evidence of fracture. Adjacent lung field is clear. No contusion or laceration was visible in this region.

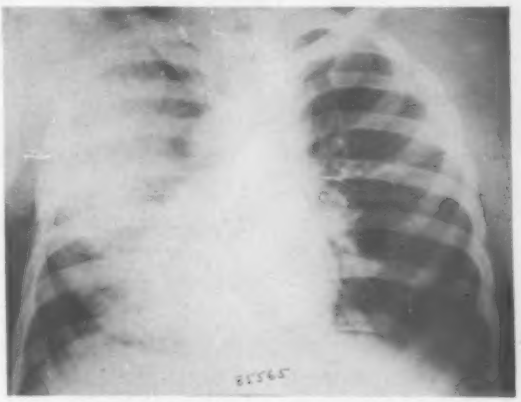

Fig. 2*b*. Traumatic pneumonia. Roentgen examination of same patient three days later showing development of massive pneumonic consolidation in left chest. The disease developed in the region receiving the trauma. Course and resolution were uneventful.

Another form of injury from within results from aspiration of foreign bodies. Sharp irregular foreign bodies may cause injury to the lung either from their entrance or during instrumental attempts at removal. Such injury is usually manifested as pneumothorax similar in all respects to pneumothorax from other causes. With removal of the foreign body, if infection does not occur, the air in the pleural cavity becomes absorbed and re-expansion results.

The irritation incident to inhalation of dusts and gases is not included in this discussion, since they represent more the effect of irritation than actual injury.

The next question to be considered is one of great importance: What effect has trauma on the production of bacterial dis-

ease? Obviously this is a question very difficult to answer with any degree of accuracy. Reliance must necessarily be placed upon a history of trauma which is only too frequently inaccurate and uncertain. Only by prolonged observation of the effects of various types of trauma to the chest in individuals known previously to be well, will this question be settled with any degree of scientific exactness. From the observations now at our command it would be impossible to state conclusively that any type of bacterial disease of the chest is a direct result of trauma, unless infection is directly introduced into the chest cavity or lung, or a disease process previously existed in the lung.

Traumatic pleurisy is due to an irritation of the pleura produced by trauma, and has no connection with bacterial infection. Pleural effusion rarely develops and when it does the fluid is a transudate. We have never seen empyema develop as a direct result of trauma without penetration of the chest wall. One condition in which there may be some direct relation between injury and bacteria-produced disease is traumatic pneumonia. This is very rare but when pneumonia does follow injury it is usually of the lobar type presenting massive homogeneous consolidation of an entire lobe or greater portion of a lobe. There may be no roentgenographic evidence of disease for several days after the injury and then suddenly penumonic consolidation develops. The roentgenographic picture is similar in all respects to ordinary lobar pneumonia as are also the clinical symptoms and course. At times the pneumonic consolidation develops near the site of injury; at times the injury is of some remote position of the body.

Defervescence is by crisis and prompt resolution results in complete restoration of the lung to normal. It is possible, of course, that this may be a coincidental pneumonic involvement having no relation to the trauma; in any event it is a very rare occurrence. In the roentgen-ray service of the St. Louis City Hospital in which a large number of chest injuries have been seen in the past ten years, we have encountered fewer than half a dozen instances in which trauma could be established as a definite cause of pneumonic involvement.

A review of the literature discloses the fact that trauma has long been accepted as a possible cause of pneumonia. Litten[3] in 1882 spoke of the condition as "Contusionspneumonie" and reported 14 cases among 320 males with pneumonia, an incidence of 4.4 per cent.

Stern[9] reports 29 cases in a series of 1,027 cases of pneumonia as of traumatic origin, an incidence of 2.8 per cent. Most modern writers, however, hold that such figures are certainly too high and that if trauma is an etiological factor in the production of pneumonia it is extremely rare. Jürgensen and Aufrecht[2] held this view, and Pye-Smith and Beddard[6] in 1909 stated that, "it is a debatable question how far injury may determine an attack of pneumonia." They do accept it as a possible cause, however. Jürgensen and Aufrecht obtained a history of trauma in not more than 0.13 per cent of their pneumonia patients. Norris and Farley[5] found 58 cases in 6,790 collected cases, an incidence of 0.58 per cent. This figure is probably more nearly correct. Cole[1] failed to find a single instance in 770 cases of pneumonia.

When one considers the other conditions associated with trauma, such as pleurisy, massive atelectasis, contusion of the lung with interstitial hemorrhage, etc., which could easily be confused with pneumonic involvement, it is evident that this may account for the higher percentage reported by the older observers before the advent of the roentgen ray as a diagnostic agent. Likewise a few writers recognize a group of cases in which pneumonia results following severe trauma to some remote portion of the body on account of lowering of resisting power of the body or from nervous shock. In such a group are included pneumonia following operation; confinement; extraction of teeth; emboli occurring during the course of a septic infection from a

wound. Such a classification is obviously beyond the scope of this discussion.

The question of development of pulmonary tuberculosis after injury to the chest is also one of great importance, but one in which any accurate data are equally difficult to obtain. Inquiry from 500 patients suffering from pulmonary tuberculosis at Koch Hospital elicited a history of trauma in 32 instances. I am indebted to Dr. G. D. Kettlekamp and his staff of physicians for making this analysis for me.

Mrs. B. was in an automobile accident three years before her condition was diagnosed as tuberculous, at which time she fell against the steering wheel and injured her chest.

Miss K. was in automobile accident three and a half years before her condition was diagnosed as tuberculous. The car fell on her, crushing her chest and she had hemoptysis at that time.

Mrs. F. Automobile accident one year before diagnosis of tuberculosis was made; suffered injuries to head, and shaken up slightly.

Mrs. M. Automobile accident one year before her condition was diagnosed as tuberculous. Injured hand and shaken up a bit.

Mrs. H. Automobile accident, slight injury to chest and shoulder three years before diagnosis of tuberculosis was made.

Miss V. Four years prior to onset of illness patient was injured in automobile accident. Was injured twice; once had injury to lower left chest. Scar still remains; no ribs broken.

E. R. was thrown through windshield of automobile a short time before she became ill (about six months before onset of illness). She was unconscious at that time.

I. McC. was hit in back by service car two years prior to development of tuberculosis.

Miss B. Seven months before becoming ill patient was in automobile accident. Was in rumble seat of car when it went off the road. Sustained broken nose and injury to wrist. Was unconscious at time. About one month later was in another accident in which she was knocked unconscious but suffered no after ill effects at that time.

Mrs. S. At age of sixteen patient had severe blow on right upper chest. After that had several severe blows to chest and back (fist blows). This occurred about five years previous to her tuberculosis.

Mrs. M. was in automobile accident about eighteen years ago. Was unconscious and severely bruised.

Miss N. Six months prior to illness patient fell from bus and sustained laceration of leg. Not unconscious at time.

Miss P. Twelve years prior to illness with tuberculosis patient fell downstairs; legs were paralyzed. Had operation later and regained use of legs.

Mrs. C. broke ribs in 1914, and diagnosis of tuberculosis made in 1930.

Miss C. broke two ribs and punctured lung in 1924; diagnosed tuberculous in 1926.

Mrs. H. Automobile accident six weeks before she was diagnosed as tuberculous in 1927. Injury to abdomen.

Miss H. fell off horse in 1924, diagnosed tuberculous 1929.

Miss T. In automobile accident in 1925; injury to head. Diagnosed tuberculous in 1929.

Mrs. R. fell on ice in 1930. Diagnosed tuberculous in 1931.

Miss A. fell on chest when a child—1914. Diagnosed tuberculous in 1931.

Miss P. Colored. Broke leg in 1917; broke hip in 1916; diagnosed tuberculous in 1923.

Mr. C. Injured back three and a half years before diagnosed as tuberculous. Tuberculosis of spine as well. Diagnosed three years ago.

Mr. H. Fell on left side August, 1931. Left lung diagnosed as tuberculous February, 1932.

Mr. L. Struck by automobile, left side, 1929. Tuberculosis left lung diagnosed in 1930.

Mr. A. Log rolled over chest 1924. Tuberculosis left side diagnosed in September, 1930.

Mr. D. Left side hit by auto. Not severe, 1928; left lung diagnosed tuberculous 1930.

Mr. A. Broken right collar bone, twenty years ago. Bullet wound upper right chest, 1927. Tuberculosis right lung diagnosed in 1930.

Mr. S. Injured right side, 1930. Diagnosis of tuberculosis made one week later.

Mr. M. Crushed in elevator one year before onset of tuberculosis at which time received fractured spine and jaw.

Mr. C. Automobile accident three months before onset of tuberculosis. No special injury.

Mr. W. Fell on edge of table injuring lower chest six years before onset of tuberculosis. Said no ribs were broken at that time.

Mr. P. Painter, fell and injured shoulder five years before diagnosis of tuberculosis was made.

Total	White females	20	Colored females	8
32	White males	3	Colored male	1

It will be noted that the time elapsing between injury and the diagnosis of tuberculosis varied over a wide range—one week to eighteen years. In over half of the instances the chest itself was not shown to be directly involved in the accident—in some instances the trauma was confined to an extremity. In no instance was any patient shown to be free from the disease prior to injury.

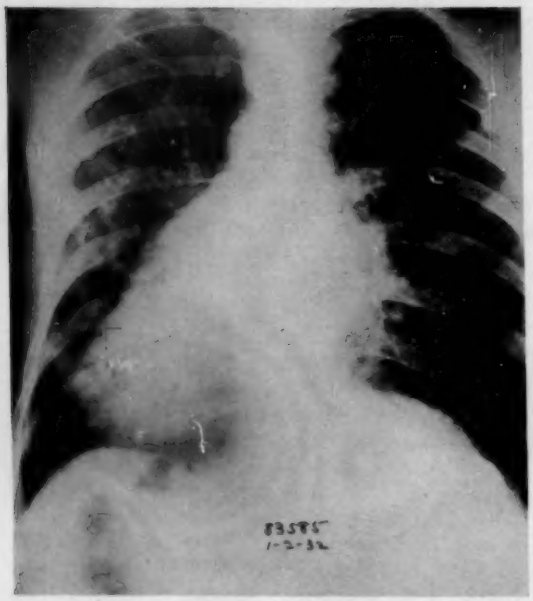

FIG. 3*a*. Anterior roentgen examination after injury. No fractures, no evidence of trauma on chest wall; nothing to indicate injury to the lung at this examination.

When the widespread occurrence of trauma of one sort or another and the prevalence of pulmonary tuberculosis are considered, it would not be justifiable to assume that the one was a determining factor in the production of the other. Where a definite tuberculous process is already present, an aggravation and extension of the condition from trauma could be more readily explained by a disturbance of the barrier of defense tissue about the lesion. Where tuberculosis subsequently results after trauma in an individual previously free from the disease, the supposition is that lowering of the patient's resisting power, either locally or generally, has given opportunity for the development of an ever present tuberculous infection.

Shipman[8] holds this view and maintains that "pulmonary tuberculosis develops within a reasonable length of time in a previously healthy individual following trauma to the chest, sufficient to cause functional impairment. Fractured ribs or clavicle or severe contusions should be considered prima facie evidence of such an injury." It would seem that before such a statement is accepted it should be more fully substantiated by numerous instances in which individuals previously demonstrated to be well, are shown to have developed tuberculosis within a reasonable length of time following trauma to the chest. Such cases should be supported by roentgen examination, laboratory examinations and all other available methods of diagnosis. Until this is accomplished the statement that trauma is a factor in the production of pulmonary tuberculosis will be challenged.

Surely in the face of these statistics we must admit that trauma certainly does not play more than a very minor part in the development of the disease. It is logical to suppose that trauma severe enough to cause actual injury to the lung might disturb the bodily defenses against a preexisting tuberculous lesion by removing the fibrous tissue barrier and permitting an advancement of the disease, but that trauma alone is an etiological factor in its development is highly speculative.

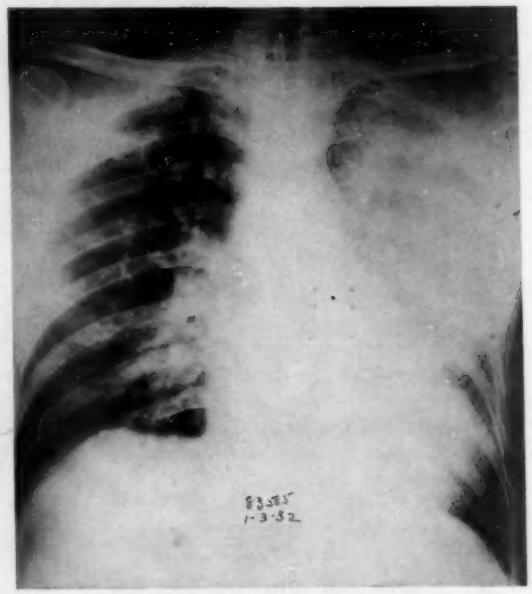

FIG. 3*b*. Posterior roentgen examination the following day showing dense consolidation of the left lung due to traumatic pneumonia. Course and resolution were uneventful. Pneumonic involvement was near site of injury.

In conclusion, it may be said that unless infection is actually carried into the pleural cavity by the effect of trauma, there is little likelihood of bacterial infection occurring. If infection does not develop, injuries to the chest heal completely with little danger of subsequent disability. If infection does occur from direct inoculation the roentgenographic appearance and prognosis are the same as that accompanying the same condition from any other cause. Likewise, since trauma has not been proved to be a direct etiological factor in the production of bacterial disease of the chest, any effect produced is probably produced indirectly by lowering of the general resistance incident to trauma, or the activation of a preexisting disease.

There seems to be a small percentage of cases in which slight trauma, insufficient in itself to operate through the mechanism of lowered bodily resistance, is followed by definite pneumonic consolidation. The exact mechanism by which this occurs is not known; the incidence is extremely low.

That tuberculosis ever develops in a previously healthy individual as a direct result of trauma in a similar manner seems very doubtful; if such instances do occur they must be extremely rare.

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TRAUMA AS AN ETIOLOGICAL FACTOR IN MALIGNANCY*

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THE subject of trauma as related to malignancy has been under intensive study since 1863 when Virchow[39] presented his theory of chronic irritation in the causation of tumors. There are now more than three hundred contributions to the subject, comparatively few of which are in the English language. Although embryology and microbiology have added something to the present knowledge, the theory of chronic irritation has survived as the most widely accepted etiological factor in malignancy. In the present industrial age the question of trauma, especially the single severe trauma as contrasted with the repeated slight injury, has reached a place of first importance not only to the medical and legal professions but to the public at large because of the extensive holding of accident insurance and of the workman's compensation laws.

Among the contributions to this subject there are several masterly reviews: those of Graef[12] (1913) where one hundred and sixty references are cited, and of Knox[17] (1929) where the whole subject is brought up to date, are especially commendable.

PRESENT STATUS OF THE PROBLEM

The present status of the problem may be readily expressed by referring to the summaries of previous contributions.

Thiem[37] (1909) declared that trauma is not the real cause of tumors, but that among the accessory causes it plays a very important rôle. Thiem's criteria for accepting a malignant tumor as traumatic in origin were:

1. Definite proof of accident.
2. Trauma must be of such severity as to produce injury.
3. Tumor need not be in exact site of injury as long as it occurs within the lines of stress produced by the trauma.
4. Interval between accident and appearance of tumor must be reasonable—for sarcoma not less than eight days; for carcinoma not less than three to four weeks.

Berard[3] (1910). It appears undeniable that, in predisposed subjects, notably by heredity and in conditions which escape our present method of analysis, trauma determines the appearance or favors the development of tumors. A single trauma, especially a severe contusion on tissues healthy in appearance, may be sufficient. This was observed particularly in sarcoma of soft parts, bones and in tumors of the brain. The time between the trauma and the appearance of the tumor may vary from several weeks to several years.

Phelps[29] (1910), considering only epithelial tumors. (1) "Cancer is primarily dependent upon a cause which is congenital, is hereditary in a certain proportion of cases and is as inexplicable as the force which determines in ovo the future sex and peculiarities of the individual. (2) Its development is favored by various indeterminate and non-essential conditions. (3) Its proximate cause is as yet entirely unknown and its future determination will depend upon the possible verification of a parasitic infection."

Coley[5] (1911). (1) "Local trauma of any kind from chronic irritation to a single local contusion, is not infrequently the direct exciting cause of malignant tumors of all types." (2) "That a single local injury may cause a carcinoma as well as a sarcoma is no longer open to speculation. The cases that I have submitted fulfill all the conditions necessary to establish a definite causal relationship between a single trauma and the development of a cancer." (3) "While we must admit that trauma often plays an important causative role in the formation of malignant tumors, this relationship must be clearly and definitely established . . . ."

Lubarsch[21] (1912). "A causal relationship of a single trauma to the development of tumors is considered probable if (1) the trauma was of such a degree as to cause distinct and continuous changes at the place where the tumor subsequently develops; (2) the interval between

* From the Department of Pathology, Henry Ford Hospital, Detroit. Read at the Thirty-third Annual Meeting, American Roentgen Ray Society, Detroit, Mich., Sept 27–30, 1932.

trauma and tumor is such as to account for the size and histological structure of the tumor. Acceleration or exacerbation of an already existing tumor is only probable if, (a) The trauma was of such a nature and localization as to cause distinct changes, particularly in the cell metabolism of the tumor. (b) The growth of the tumor was increased as compared with the empirical normal. (c) the histological examination revealed distinct traces of an injury, fresh hemorrhages, unusual necrosis and signs of extraordinary acceleration of growth."

Eunike[6] (1919) reports 6 cases of bone sarcoma possibly due to a single trauma but he believes that other factors enter their causation because of the rare occurrence. Points required for recognition of traumatic origin of sarcoma:

1. Trauma must be certain.
2. The intactness of part before trauma must be unquestionable.
3. The trauma must be of such a kind and degree as to injure the part.
4. The neoplasm must be found at the place of the injury.
5. The tumor must have developed after the trauma.
6. A temporal relation of the trauma to the onset of neoplasm should be recognized.
7. There should be continuous symptoms between the trauma and the evolution of the tumor (bridge symptoms).

Ophüls[26] (1921) states that "a single trauma not followed by complications is a rare cause of tumor. Complete data, including roentgen examination immediately after accident, are essential." Consensus of opinions on essential rules regarding trauma and malignancy are:

1. The occurrence of the trauma must be proved.
2. The trauma must have been severe enough to appear effective.
3. The growth must develop at a place likely to have been injured by the trauma.
4. It must be reasonably certain that the traumatized part was normal before the accident.
5. The time elapsing between the trauma and the appearance of the tumor must agree with our scientific experience in the rapidity of the development of the particular type of tumor under consideration. The time must not be too short, not less than several weeks, nor too long, usually given as two years.

Sauerbruch[32] (1925). General disorders play a much greater part than local disturbances in the genesis of tumors. Restates criteria as follows:

1. The injury must have been due to force, not to shock or fatigue.
2. The impact must have been sufficiently violent to produce marked changes forcing the patient to cease work at the time.
3. Carcinomata or sarcomata must develop at the site of injury.
4. The tumor must develop within a certain period (three weeks to three years in the case of sarcomata; one month to two years for carcinomata), though these intervals may be longer if so-called bridge symptoms can be demonstrated.

Ewing[9] (1926). "There is not a single form of supposed traumatic cancer that does not arise frequently in the same form free from any suspicion of trauma. Conditions provided before trauma can be accepted as the cause of a tumor as established by rulings and statutes of most European countries and best American practice:"

1. The authenticity and sufficient severity of the trauma.
2. Previous integrity of the wounded part.
3. The identity of the injured area with that giving origin to the tumor.
4. The tumor must be of a type that could conceivably result from trauma.
5. There must be a proper time interval between the receipt of the injury and the appearance of the tumor.

Such data are difficult to obtain. Nevertheless without them one cannot assert that a tumor is of traumatic origin.

Knox[17] (1929) quotes Lubarsch as giving the best summary as follows:

1. Blows and other injuries generally call attention to hitherto unsuspected tumors and proof of the existence of such unsuspected growth is given by the fact that neoplasms which have never given recognizable symptoms are constantly being discovered at autopsy.
2. Injuries are infinitely more frequent than neoplasms.
3. Many tumors have a long latent period.
4. Experimental evidence for the theory that

a single trauma can cause a tumor is lacking.

Knox's conclusions were:

1. Literature leads to the conclusion that a causative relation between a single trauma and a tumor has never been completely established.
2. Examples cited suggest possibility that a single trauma may induce a tumor, but proof is lacking.
3. A causative relationship can never be established until it is demonstrated by experimental methods that a single injury can regularly produce a tumor.
4. The award of compensation solely on the basis of the production of a tumor following a single trauma is therefore unjustified.
5. The award of compensation on the basis of trauma acting as a collateral or adjunct may be justifiable if proof of the injury is received and tumor is proven by the microscope.
6. Trauma which merely calls attention to a pre-existing tumor is not a valid basis for compensation.

It is quite apparent that the clinical evidence and the opinion of clinicians is more favorable to the theory of the traumatic origin of malignant tumors than the experimental evidence and the opinion of research workers or the pathological evidence and the opinion of pathologists. The difference of opinion lies not in the criteria alone but largely in the strict adherence to objective data to make up the criteria. The patient's history uncorroborated is insufficient.

Further consideration of the problem necessarily is limited to recent data and may be divided into experimental and clinical.

EXPERIMENTAL

As early as 1863 Virchow[39] admitted that trauma might produce a malignant neoplasm, but qualified his admission by demanding a predisposition in the patient and a soil made favorable by pre-existing pathology. Heredity may now be spoken of as a predisposing factor in malignancy from the experimental viewpoint at least, although not readily demonstrated in man. Slye[35] has recently presented data on neoplasms in mice at the site of gross trauma, including detailed protocols. The traumata recorded are of the major variety including bites, fractures and lacerated wounds from cage doors, etc. Of the 14,000 autopsies recorded, 1,301, or 9.2 per cent, showed neoplasms. Fifty-one of the 1,301, or 3.8 per cent, arose in the site of recorded traumata, thus making an incidence of malignancy of 0.36 per cent due to trauma. There were 34 malignant tumors—30 sarcomas, or 88 per cent, and 4 carcinomas, or 12 per cent. The high percentage of sarcomas following trauma is perhaps significant as one is impressed from the protocols given by the fact that most of the stock was carcinomatous rather than sarcomatous. It is emphasized that, in the non-cancerous strains of mice bred in the same laboratory, identical traumas have occurred without a single tumor arising. Slye's conclusion that the described hereditary predispositions and external gross traumas were the interrelated causes of the occurrence of neoplasms seems conservative. The data refute to some extent the often quoted point of Lubarsch that the experimental evidence for the theory that a single trauma can cause a tumor is lacking, but hardly answers the challenge of Knox that, "The causative relationship can never be established until it is demonstrated by experimental methods that a single injury can regularly produce tumor," because the incidence of trauma is not recorded. However, this is the first extensive experimental contribution which applies directly to the problem and is a long step in the proper direction.

Endocrine abnormalities and imbalance have again been brought forward as predisposing factors in malignant disease, this time with more tangible experimental basis. In 1930 Zondek[41] showed that out of 118 cases of malignant tumors 15 per cent were excreting in the urine sufficient anterior pituitary hormone to produce a positive Aschheim-Zondek reaction in immature fe-

male mice. More recently it has been shown that teratoid tumors of the testicle give a high percentage of positive Aschheim-Zondek tests. Further, the removal of the anterior lobe of the pituitary has been shown to arrest or at least retard the growth of malignant tumors in the experimental animal. In our own laboratories anterior lobe extracts, supplied through the courtesy of Parke-Davis and Company, have increased the number of takes in transplanted carcinoma as well as the rate of growth of these transplanted tumors in the rat.

The disturbance of calcium and phosphorus metabolism, associated in many instances with hyperfunction of the parathyroid glands and resulting in osteitis fibrosa cystica and Paget's disease, are frequently associated clinically with tumor formation. As Jaffe[15] has shown, osteitis fibrosa cystica is readily produced by injections of parathormone. Paik[29] has now carried the work a step further by daily injecting parathormone into rats with transplanted tumors, increasing the growth three times over that of the controls. Removal of the parathyroids in these animals, on the other hand, retarded the growth of the transplanted tumors.

These two groups of experimental observations on glands of internal secretion and heredity in relation to tumor growth make the conception of predisposition to malignancy a tangible thing capable of much further investigation. It is possible, of course, that hereditary predisposition and endocrine predisposition are one and the same.

CLINICAL

Clinical investigation of the relation of trauma and malignancy is at the present time most unsatisfactory largely because it is impossible to evaluate the history of the patient, even when the history is obtained by an experienced investigator and leading questions are carefully avoided. Examination immediately after the accident, including roentgenograms, is required to satisfy the criteria outlined above, particularly regarding the extent, nature and location of the injury and exclusion of pre-existing malignancy. Even when the examination is done it is difficult to determine the integrity of the part before the injury except in case of fracture. The impression is gained, in reviewing the clinical articles, that the relationship is established by mere multiplication of cases without strict observance of all the criteria set up by the author himself, to say nothing about satisfying the accepted comprehensive criteria. Similar criticism must be made of the large compilation of cases where complete history and data are rarely if ever available. The most reliable reports should come from an experienced investigator familiar with the subject, or a small group working under the direct supervision of such an individual. The records of the large hospital or clinic, where these are obtained by an ever-changing group of young physicians, are open to question. For example, in a group of 150 breast cases in our own clinic there is a recorded traumatic factor of 9.3 per cent, but a critical review of these histories does not reveal a single case which satisfies the comprehensive criteria necessary to establish this factor.

It is logical to consider first the tumors of the skin and mucous membrane, since these areas are traumatized more often than other parts of the body.

1. Carcinoma of the skin. Seventy-five cases of basal cell carcinoma are reported by Paul[28] in which there was a definite history of trauma in 21, or 28 per cent. The injuries mentioned were mosquito bite, cut while shaving, scratch from pin, burn from hot grease while cooking, burn from hot tar while repairing roads, etc. Obviously with such minor injuries the integrity of the part before the injury could not be established, and few, if any, were observed until the tumor was fully developed. A more acceptable case is that of F. C., male, aged forty-seven, seen in our cancer clinic, whose face was free of skin lesions at time of employment but was struck on the chin by a piece of hot steel. He was immediately

treated in the accident department. The wound was clean and there was no evidence of tumor. The wound did not heal, but left a shallow ulcer, and one and a half years later the present condition, consisting of a small fissure with slightly elevated rolled edges, developed. Removal and sections confirmed the clinical diagnosis of basal cell carcinoma.

Squamous cell carcinoma of the skin and mucous membranes resulting from trauma is frequently reported, but the great majority of these arise in pre-existing lesions such as old scars, chronic ulcers, areas of keratosis or leucoplakia. Areas of marked keratosis in the sunburned, weather-beaten face of the farmer are frequently the site of squamous cell carcinoma. Trauma merely accelerates growth or more often calls attention to the lesion by removing the scab. A similar situation is connected with leucoplakia of the mouth and tongue. The best examples of squamous cell carcinoma in relation to trauma are the recent ones recorded by Schad[33] resulting from war wounds. The first is a male, aged twenty-six, whose left cheek was penetrated by a bullet in November, 1914. Healing was satisfactory, but in March, 1915, scar became thickened and in June, 1915, while on active duty at the front, was shown to have a squamous cell carcinoma involving all parts of the former wound. The second was a male, aged thirty-six, whose left temple was grazed by a bullet and injured in February, 1915. Wound healed in three weeks allowing return to front. In July the scar became painful and in August he could no longer wear his helmet because of ulceration and pain.

2. Melanoma. The development of malignancy in the pigmented mole (nevus pigmentosus) represents one of our best examples of ready transition from a benign congenital lesion of long standing to one of high malignancy. This transition often takes place without a known aggravating factor, but chronic irritation, repeated minor traumata or a single major trauma are recognized as precipitating causes. We are probably never justified in attributing malignancy in these nevi to a single trauma because of their known tendency to spontaneous change, and a careful microscopic examination of the entire lesion before injury would be required to rule out cellular malignancy. However, aggravation and acceleration must be admitted in many of these cases, and an example cited by Evans and Leucutia[7] serves well to illustrate: G. W., white male, aged twenty-six, had had a pigmented mole on the inner aspect of the upper third of the left leg since birth. August 21, 1928, this was injured by flying metal causing bleeding and subsequent infection. Ulceration persisted and the whole lesion was excised five weeks after injury. No suggestion of malignancy was found. Four months after injury there was recurrence in the wound, and a diagnosis of melanosarcoma was made. Recurrences and metastases from this group are often recorded, sometimes following partial surgical removal, electrocoagulation and deep roentgen treatment. Several years ago Warthin and Case, in a paper still unpublished, presented the view that the important factor in these unfortunate results seemed to be the enclosure of some of the scattered chromatophores in scar tissue. Their studies suggest trauma as a possible indirect factor activating the cells through scarring. Review of 58 cases, obtained from the personal files of Dr. Evans and Dr. Nolting, showed 5, or 9.8 per cent, activated by a single trauma; 4, or 7.8 per cent, activated by repeated traumas or chronic irritation; 7, or 13.7 per cent, activated by operative removal. According to the work of Masson[24] melanomas are tumors of nerve endings, and the specialized nerve terminations of the Meissner corpuscles have been confirmed by other observers. The acceptance of this view would place the derivation of this much disputed group with the neurogenic tumors. Stewart and Copeland[36] discuss the whole subject under the title of neurogenic sarcoma.

The neurogenic tumors, according to Stewart and Copeland, may now include

most of the so-called fibromata and fibrosarcomata of the skin and soft parts. Of the 129 cases of neurogenic sarcomata reported by Stewart and Copeland, only 3 claimed trauma as an etiological factor, and in none of these is the evidence convincing. However, the regularity with which a long stationary tumor recurred and grew rapidly after the first or second surgical removal points to the definite possibility of activation by trauma in this group.

3. Carcinoma of the breast. Traumatic history in breast carcinoma is obtained in almost any patient if leading questions are asked, and, avoiding this error, trauma is frequently given as a cause by the patient. Trauma has been recorded as an etiological factor in from 2.6 per cent by Hildebrand[14] to 44.6 per cent by McWilliams.[23] The statistics on trauma antecedent to breast carcinoma from various countries are given by Lane-Dayton[19] as follows:

Country	*Author*	*Total Cases*	*Cases of Trauma*	*Per Cent*
England	5	742	129	17.4
America	6	1,133	190	16.8
Germany	15	3,003	244	8.1
Austria	2	858	88	10.2
Switzerland	4	495	60	12.1
Czechoslovakia	2	583	50	10.3
Norway	2	176	15	8.5
Denmark	1	210	14	6.6
Italy	1	204	11	5.4
Hungary	1	108	11	10.2
		7,510	822	10.9

Luff[22] in 1932 found a history of injury in only 8 per cent of 1,651 cases reviewed and declared the history of dubious nature in many of these. On the other hand, there was a family history of cancer in 23.1 per cent.

The high incidence of chronic cystic mastitis in the breast alone would rule out the possibility of most cases satisfying the criteria necessary for admission of traumatic origin. A critical analysis would probably fail to confirm the traumatic origin of a single case as pointed out in our series.

4. Tumors of body cavities and internal organs. There are no tumors of the pleura with reasonably good history for traumatic etiology. Only two carcinomas of the lung recorded in the literature are worthy of consideration. One of these is the familiar case of Lepine[20] which died five weeks after the accident, too soon for the development and fatal infiltration of carcinoma. The other is that of Wells and Cannon:[40] Male, aged fifty, knocked down by an automobile fracturing 3, 4 and 5 ribs. Fractures were confirmed by roentgen examination, but nothing suggestive of lung tumor was found. Lung injury was indicated by hemoptysis and subcutaneous emphysema over the entire body. Eleven months later the patient developed cough and other symptoms suggestive of tuberculosis. Roentgen examination at this time showed carcinoma in site of fracture. Autopsy showed a mesothelioma. This case satisfies all criteria closely.

Tumors of the intestinal tract are generally conceded to be activated by chronic infection and irritation, as are those which arise in the stomach on the basis of peptic ulcer, those in the gallbladder almost invariably associated with gallstones, and those in sigmoid and rectum associated with polypi. It is difficult to conceive of a trauma of such type and severity as to injure the lining mucosa without causing perforation directly or indirectly.

Tumors of the uterus, tubes and ovaries, especially of the cervix, are often ascribed to trauma but the type of trauma associated with tears during childbirth. This is confirmed to some extent by the fact that from 80 to 90 per cent of cervical carcinoma occur in women who have borne children.

Tumors of the urinary system, particularly those of the kidney, loosely grouped under the term "hypernephroma," are important because trauma is frequently claimed as a cause of the primary tumor and the localization of metastases, particularly in bone with or without pathological fracture. So-called hypernephromata arise from adenomata or congenital rests (Grawitz's adenoma). Hence the most that could be claimed would be activation of a preexisting tumor. Rückart[31] has reviewed 117

cases from the literature with history of trauma in 9. Of the 9 only 4, or 3.4 per cent, are truly suggestive of traumatic origin. Rückart's own case fell from a roof sustaining a blow in the mesogastrium. This was followed immediately by blood and pus in the urine, although there had been no previous kidney difficulty. Dr. Nolting has reviewed 40 cases of hypernephroma in Harper Hospital, Detroit, and finds only one case with a history of trauma. In this case there were no immediate symptoms of kidney damage, and the tumor appeared three years later. It would be almost impossible to determine the integrity of the kidney at the time of the accident, and if adenomas or Grawitz's tumors were present, only careful microscopic examination would prove that malignancy was not present before the trauma. The possibility of the activation of a congenital rest or adenoma is the only thing to be considered, and then only when there are immediate signs of kidney injury such as bleeding, anuria, etc.

Tumors of the testicles, like tumors of the breast, have frequently been designated as traumatic in origin probably because the testicles are subject to trauma and any injury in this region is very painful, making a lasting impression on the recipient. As Ewing[8] points out, it is best to consider this group of tumors from the standpoint of their teratomatous origin, and they can be separated from any serious claim of traumatic origin on this score alone. The congenital basis, coupled with the recent demonstration of hyperactivity of the anterior lobe of the pituitary in this group, makes it seem beside the point to suggest more than the activation of a pre-existing lesion with endocrine background. Unconvincing cases, such as that of Kopas,[18] are recorded in the literature. Male, aged fifty, a brewer, was shot in thigh and testicle. Bits of lead remained in the testicle but the wound healed readily. Four years later a rapidly fatal carcinoma of mixed type appeared.

Three cases of lymphosarcoma are recorded as caused by trauma, those of Pistocchi,[30] Fiddes and Phillips,[11] and Cenini.[4] Of these, the case of Fiddes and Phillips is of most interest. Male, aged fifty, was struck on back of neck with a leather belt from a machine. Three days later a lump appeared at the site of injury, and in two months a whole chain of glands on this side of the neck was enlarged and indurated. Autopsy revealed extensive involvement of all the abdominal glands, and it was concluded that this was the primary site of the sarcoma. The medical referee, however, awarded compensation, because of:

1. Definite evidence of injury, namely, blow at the back of the neck arising in the course of his work.
2. Appearance of a swelling close to the site of injury shortly afterward.
3. Possibility of such an injury (*a*) causing activity in a previously existing sarcoma; (*b*) precipitating such a development.

In view of the autopsy findings neither of these possibilities was correct, but a third should be considered, that is, the injury may have influenced localization in the neck from the advanced abdominal tumor. This possibility is well illustrated in the experimental work of Jones and Rous[16] where it was shown that mouse carcinoma could be influenced to localize by a local mechanical irritant. They conclude that secondary localization of tumors at points of injury may be attributed with good reason to the presence at such points of an active connective tissue capable of elaborating a stroma rapidly and abundantly. Granting that injury had to do with localization in the neck, it was not a cause of disability or death, and hence the compensation was unjustified. By the same token, if injury could be shown to influence localization to vital spots causing disability or death, trauma might be more often a just cause for compensation in tumor cases.

Brain tumors are frequently associated with injury by the patient. Adler[1] in 1899

collected 1,086 cases in which 96, or 8.8 per cent, gave a history of trauma. With the brain, integrity of the part before injury and actual destruction of tissue are criteria that are hard to satisfy. The most plausible cases are those reported by Neubürger[25] of brain gliomata following gunshot wounds. Three brains with tumors following gunshot wounds are preserved in the museum of the German Research Institute for Psychiatry. Neubürger accepts 2 cases as directly due to the injury, but grants that a certain disposition on the part of the patient to tumor must be considered.

Bone sarcoma is more frequently referred to trauma than either sarcoma of soft parts or carcinoma. Like trauma to the testicle, trauma to bone is usually quite painful and in addition there is usually sufficient reaction to produce a palpable tumor which remains for some time. The pain and tumor focus the patient's attention on the injury and, if sarcoma ever develops in that region, the injury is regarded as the cause. The use of the roentgen ray to check a possible fracture at the time of the injury gives a permanent record which assures the integrity of the part so that in a properly observed case there should never be a question of pre-existing tumor. Traumatic periostitis and callous formation are such active reparative processes that, even with the microscope, they are difficult to distinguish from sarcoma. Hence, as far as the local tissues are concerned, there is little margin of safety. Sarcoma is often reported as developing in the callus of a fracture as in the case of Haberan:[13] Male, aged fifty-four, whose fracture at the lower end of the humerus healed satisfactorily in six weeks but developed a large osteochondrosarcoma in the following nine months. Troell,[38] in a critical review of 59 bone sarcomata, concluded that 9, or 15 per cent were undoubtedly due to trauma and that the subperiosteal hemorrhages with the subsequent organization were particularly favorable for the development of sarcoma. Ewing[10] feels that there is convincing evidence that benign giant cell tumors result from hemorrhages, often traumatic and usually into areas of osteitis fibrosa cystica. The etiological factor in osteitis fibrosa cystica is an excess of parathormone either injected experimentally or produced by parathyroid tumors. Development of osteogenic sarcoma in these giant cell tumors has been seen frequently. Ballin and Morse[2] place Paget's disease in the same group with osteitis fibrosa cystica and believe that both are due to parathyroidism. If we accept this point of view, all cases of parathyroidism, including Paget's disease, would constitute a predisposition to sarcoma on a hormonal basis, and trauma in such cases could be considered as an incidental or at most an activating factor. Unpublished statistics, furnished by Bloodgood and Geschickter, of cases recorded in the Surgical Pathological Laboratory of Johns Hopkins Hospital, give 179 bone cysts with a history of trauma in 55, or 31 per cent, and 206 giant cell tumors with a history of trauma in 74, or 31 per cent. These figures tend to confirm the fact that trauma simply calls attention to the lesion rather than produces it.

From a statistical point of view, bone sarcoma is referred to trauma in from 10 to 50 per cent of cases. Sebestyén[34] reviewed 4,068 sarcomas, reported between 1880 and 1920, of which 612, or 15 per cent, were associated with trauma. Of 429 bone sarcomas 231, or 44 per cent, were recorded as being referred to a single trauma. As pointed out by Codman, bone sarcoma in persons over fifty very commonly arises in a bone the seat of Paget's disease. The relation to fracture and also to Paget's disease is well illustrated in a recent case in our orthopedic clinic. Mrs. B., aged fifty-six, had an injury to the right leg twenty years ago. There were no further symptoms for ten years when she noticed bowing of this leg. In March, 1932, the leg became swollen and tender during an attack of influenza. Examination revealed Paget's disease of the right femur with osteogenic sarcoma in the lower third. Amputation was done

with good recovery. In July, while sitting on a couch she started to rise quickly without thinking of her amputated leg, and fell injuring her right forearm. Roentgen examination revealed greenstick fracture of the radius, and Paget's disease. Pain continued and on August 24, 1932, roentgenograms revealed early changes suggesting sarcoma. At the present time there is a large bony growth with the typical ray appearance confirming previous diagnosis. This case fulfills all the criteria regarding the relation of trauma to malignancy including individual susceptibility as proved by the first tumor in the humerus and the predisposition of the part in the way of Paget's disease. In a review of 56 sarcomas of bone in the personal files of Dr. Wm. A. Evans, Dr. Nolting found 17, or 30.3 per cent, with history of trauma, but only the patient's statement was available to establish the integrity of the part at the time of injury.

Unpublished statistics in 910 bone sarcomas, studied at the Surgical Pathological Laboratory of Johns Hopkins Hospital and kindly made available by Dr. Bloodgood and Dr. Geschickter, give 215, or 23 per cent, associated with trauma. No attempt was made to select the cases, if any, that would satisfy all the criteria. Although there is a better opportunity in bone sarcoma to check up on the injury and the integrity of the bone at the time of injury by means of the roentgen ray than there is on other group of malignancy, the cases that satisfy all criteria are rare. Probably our case of sarcoma in Paget's disease is as satisfactory as any recorded. Fortunately the patient alone was to blame for the injury.

SUMMARY

1. There are accumulating experimental and clinical data indicating some types of predisposition to malignancy, especially in the fields of heredity and endocrinology.

2. Slye has produced experimental evidence that trauma may influence malignancy where hereditary predisposition is present.

3. Neurogenic tumors, including melanomas, hypernephromata and teratoid testicular tumors, all have a congenital basis so that trauma cannot be considered a true etiological factor, although it may be an activating one.

4. Either courts must recognize predisposition to cancer as ruling out traumatic etiology or employers will refuse to hire employees with such predisposition.

5. The criteria of Eunike and of Ewing with the addition, "There is no demonstrated predisposition to cancer," must be strictly adhered to by both the medical profession and the courts.

6. Few cases are recorded which satisfy the criteria necessary to demonstrate the relation of trauma to malignancy. It behooves the employer, the patient and the physician to cooperate in obtaining accurate objective data at the time of the injury as well as during the subsequent period.*

* For discussion see page 49.

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THE RELATION OF TRAUMA TO ARTHRITIS*

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THE relation of injury to disability of workmen has assumed an increasing importance during the past few decades. This is due partly to the speeding up of industrial work and the installation of labor saving machinery. The medicolegal aspect, however, has been brought to the forefront by the gradual tightening of the workmen's compensation laws. At the present time, nearly every disability is under suspicion of having been caused either by an accident or by the nature of the man's work. The physician has been obtruded into this breach because of his special knowledge, not only in regard to the amount of disability present, but also as to what other anatomical and physiological processes might be factors in producing the disability in question.

The relation of trauma to arthritis is an ever present question due to the widespread occurrence of arthritis and to the fact that the exact etiology in any given case of arthritis is often very obscure. Another disturbing factor is the fact that roentgen signs of arthritis may be present for long periods of time without clinical signs or symptoms. The words "traumatic arthritis" have come to mean those chronic changes in and around a joint after injury that resemble arthritis, such as synovial thickening, necrosis of the cartilage with narrowing of the joint space, and bone proliferation. This arthritis simulates the type which goes by the names hypertrophic, degenerative, osteoarthritis, and arthritis deformans, depending upon the nationality of the writer. We prefer the name hypertrophic arthritis and will so refer to it in this communication. This is not to imply that the atrophic type of arthritis cannot be produced by some type of trauma, but it is not the usual sequence of events.

Consideration of the general subject together with the various theories as to the anatomical joint changes which are followed by arthritis leads to certain questions: (1) Can injury produce arthritis? (2) What type or severity of injury is necessary to produce these joint changes? (3) What is the time interval between the injury and the occurrence of joint changes? (4) Can the changes which occur after injury be distinguished from those which characterize the usual types of arthritis? (5) What effect, both temporary and permanent, does injury produce on an already existing arthritis?

These questions are of great importance in medicolegal work where one is called upon for expert testimony. They are of particular importance to the roentgenologist for it is by his examination that direct evidence is obtained as to the structural changes which may result in loss of function. It is incumbent upon the roentgenologist, who desires recognition as a qualified expert witness, to make a thorough study of this subject. He should be well acquainted not only with bone and joint changes resulting from injury, but with those changes resulting from disorganization of the mechanics of the joint and those congenital anatomical anomalies which are so frequently present.

PATHOGENESIS OF HYPERTROPHIC ARTHRITIS

Various theories have been evolved from time to time to account for the underlying changes in the production of hypertrophic arthritis and much experimental work has been done in attempts to prove or disprove these theories. The principal theories relate in general to vascular changes, cartilaginous changes, and bony changes.

* Read at the Thirty-third Annual Meeting, American Roentgen Ray Society, Detroit, Mich., Sept. 27–30, 1932.

Most of the experiments were conducted with a view of producing changes in one or more of these structures.

The theory of ischemia as the etiological factor in hypertrophic arthritis was propounded by Wollenberg[29] who believed the changes to be secondary to a local arteriosclerosis. In order to prove his theory, he ligated the blood supply of the patella and thereby obtained an overgrowth of it which he believed was due to the ischemia so produced. Axhausen and Pels[4] repeated the work and ascribed the changes to cartilaginous necrosis and not to ischemia. Recently, Goldhaft, Wright, and Pemberton[15] repeated the experiments of Wollenberg and obtained considerable overgrowth of the patella in every case after nine or ten months. They state that their experiments, taken in conjunction with those of Wollenberg, admit of no doubt that at least some of the characteristic changes of arthritis can be produced by interference with the blood supply.

Leriche[24] believes the osteocartilaginous lesions to be of hyperemic origin and states that the hyperemia may be traumatic in origin. His description of the mechanism of production of these lesions is as follows.

"Trauma of an articular region produces at this level a hyperaemic reaction. If this persists for longer than ten days, it results in synovial, osseous, and cartilaginous changes. In the synovia (if it is one of great size like the knee) it gives a real subacute aseptic synovitis with marked exudation of fluid, thus creating a hydrarthrosis. In the bone it occasions active rarefaction, lacunar osteoporosis, which is evident on x-ray plates. When rarefaction reaches the subchondral part, the cartilage becomes detached, shows nutritive troubles, and is even destroyed in some parts. Then we have what is called traumatic arthritis."

Goldhaft, Wright, and Pemberton state that Leriche's principle that stasis of the circulation favors ossification is in striking agreement with the results of their work quoted above.

Cartilaginous changes have been the subject of much experimental work to determine the rôle they play in the development of hypertrophic arthritis. Axhausen,[2] after doing considerable work on this subject, came to the conclusion that cartilage necrosis with the presence of devitalized cartilage in the joint was the cause of the arthritis. Key[19] studied the joint changes after the aseptic removal of pieces of cartilage from the lower end of the femur. In some cases the operative defect healed with a smooth, shallow defect, and in others remained deep. Hyperplastic changes were usually found around the lower end of the femur, but were not necessarily in proximity to the operative defect. Changes were found also around the tibia and patella. These changes were not dependent on the presence of dead cartilage as no changes were noted in the good knee when pieces of cartilage were placed there. The author could not explain why, when two joints are subjected to the same trauma, one will heal normally and the other will show evidence of hypertrophic arthritis.

Kroh,[23] in order to test the mechanical function theory, resected one condyle of the femur in rabbits and produced changes similar to arthritis in the joint. This is hardly a fair test, however, as he produced surgical injury of both cartilage and bone as well as faulty mechanics of the joint. Key[18] tested the mechanical theory by producing knock-knee in young rabbits by forcible bending of the knees outward at weekly intervals. In seven rabbits which grew to adult life, there was definite chronic hypertrophic arthritis. It was believed, however, that the arthritis was produced by disorganization of the joint, or cartilage and bone injury, and not to faulty mechanics in weight bearing.

Numerous investigators, stimulated by Axhausen's work, have attempted to produce arthritis by the introduction of various chemicals into the joint space, but it is impossible in these cases to state definitely which anatomical injury produced the arthritis, due to the various tissues affected. However, Burckhardt,[7] in addition to the chemical injury, immobilized

the joints in some of his animals. He obtained the usual arthritic changes in the animals which used the joints, but in those with immobilization, the cartilage remained for a longer interval and was gradually replaced by connective tissue and tended to produce a picture similar to atrophic arthritis. Villi were found in the used joints and pannus in the immobilized joints. He believes that hypertrophic arthritis is a regeneration phenomenon due to cartilaginous injury.

Other investigators have employed various experimental means to accomplish the same result. Fisher[13] applied radium directly to the joint surfaces. Wehner[28] resected the patella, and Klinge[21] injected egg white into the knee joint. These, however, accomplish the same result in a different manner, except that Klinge's experiments lead us to believe that he depended upon an anaphylactic reaction as other joints in the body were similarly affected.

From the review given above, it is evident that many theories have been advanced to account for the origin of hypertrophic arthritis, and that most of them relate to some form of trauma, either physical or toxic, or both. Much of the experimental work reported could produce injury to a number of the joint structures and should not be cited to prove a theory that accounts for the production of hypertrophic arthritis by injury to a specific joint structure.

CLINICAL OBSERVATIONS

The question as to whether injury can produce arthritis is indeed an important one, and various facts and opinions must be considered in arriving at an answer.

Fisher[14] states that, "osteo-arthritis does not constitute a disease sui generis, but rather the series of physiological or pathological changes that occur in a joint when it is subjected to prolonged or oft-repeated injury, either mechanical or toxic, but of a moderate degree of intensity." He also states that in traumatic or localized osteoarthritis, trauma appears to form the main or even the sole etiological factor, and does not constitute merely a predisposing etiological element. Where trauma is the direct etiological factor, he believes it to be due to frequently repeated traumata, while in those cases where trauma is the predisposing cause, it is more likely to be caused by a solitary contusion.

Holm[17] follows Leriche's theory somewhat. He states that in a simple trauma of the knee there is first a hyperemia with congestion of the periarticular structures and synovia. If there is a severe injury, an exudation and hydrarthrosis forms which may disappear. If, however, this persists and is not absorbed, important modifications result. The bone becomes osteoporotic, the cartilage disintegrates, the synovial membrane becomes thickened and shows islands of cartilage formation; the periosteum lays down bone, and the general picture is that of deforming arthritis.

Kreuscher[22] says that continual injury causes injection of the synovial membrane and cartilaginous surfaces followed by a serous effusion. Continuation of the trauma results in hemorrhage into the joint with tissue reaction and edema of the capsule. The joint is swollen and painful, but clears up if rest is instituted at this stage. If trauma continues, a definite fibrillation occurs with erosion of the surface cartilage and with villous degeneration of the edge of the synovial membrane. These changes are not uniform throughout the joint, but erosion may be seen at one place and overgrowth at another.

Axhausen[3] believes that the injury must be severe enough to cause damage to the cartilage in order to produce arthritis deformans. He believes that hemarthrosis cannot be the cause of arthritis deformans, but that it can produce changes in the capsule and synovia by organization of the fibrin followed by fibrosis and contractures. He states that it is well known that patients with arthritis deformans react to slight trauma with the production of effusion into the joint.

Engelhardt[8] also states that a definite

injury to the cartilage is necessary to produce arthritis deformans. It is not due to the injury of the cartilage itself, but is due to loss of elasticity of the cartilage secondary to circulatory disturbances. Small superficial cartilaginous necroses are secondary in nature and are not responsible for the development of the arthritis deformans which develops at the site of deeper necrotic cartilage.

Schmidt[26] believes that injury to the joint followed by exudation and failure of absorption of the deposit of fibrin can lead to proliferation of the synovia and secondary changes in the joint cartilage. Graessner[16] also believes that hypertrophic arthritis may be a secondary result of trauma. In discussing this matter Blencke[5] states that in the development of traumatic arthritis, a traumatic genesis can be accepted only when trauma was applied directly to the affected joint and was of sufficient severity to cause definite changes in the cartilage of the joint which is then followed, secondarily, by deforming changes.

Zollinger[30] is of the opinion that necrosis of cartilage does not necessarily lead to the typical findings of hypertrophic arthritis. It is likely to occur only in those cases in which there is very marked injury to the cartilage and blood vessels with long-standing disturbance of nutrition. Hemarthrosis in an otherwise normal joint cannot be considered as the cause of hypertrophic arthritis. Sonntag[27] states that the most common causes of cartilage damage are intra-articular fractures and dislocations, ligamentous tears, displacement or tear of the menisci, or breaking off of pieces of the cartilage itself.

Key[20] states that the following types of injury may produce traumatic arthritis: (1) single severe injury to cartilage; (2) repeated mild injury to cartilage; (3) disorganization of the mechanics of the joint; (4) abnormal function in a joint on account of bony deformity so that use brings about repeated injury to the joint surfaces; (5) gradual deformity in a joint as a result of abnormal pressure.

All of these types of injury, however, resolve themselves into the first two types. Any type of deformity, foreign body, occupational trauma, infection, etc., that can produce cartilaginous injury may be followed by reactionary changes which are commonly called traumatic arthritis.

The earliest joint changes seen by Ewald[11] occurred in a knee six weeks after injury. This was known to be normal previous to injury. Sonntag[27] believes that arthritis can occur as early as four weeks after injury or may be delayed for years. It usually takes from three to six months to show clinical and roentgenological signs. Schmidt[26] states that arthritis due to static deformities usually does not occur later than two years after injury and that changes occurring many years later are to be disregarded. In the opinion of Zollinger,[30] the more severe the injury, the earlier will be the arthritic changes, and vice versa. Axhausen,[3] after considering this question, concludes that one cannot set up hard and fast rules but that on the basis of clinical and roentgenological considerations, one must judge each case.

The progressive development of traumatic arthritis is quite similar to the changes seen in hypertrophic arthritis. In the early stages there is injection of the synovia and cartilaginous surfaces, and frequently a serous or bloody effusion is present. The joint is swollen and painful. If progression occurs, the articular surfaces become roughened and there is edema of the capsule. In the later stages both show disappearance of the joint cartilage, thickening and fibrosis of the capsule, synovial hypertrophy, and the production of osteophytes around the articular margins. Roentgenologically there is little difference to be seen between the two kinds of arthritis unless there has been demonstrable bone change at the time of injury or unless there is some structural deformity of the part.

Hypertrophic arthritis tends to be generalized and to have a gradual onset in the later decades of life, while traumatic arthritis usually is localized to one joint and

there must be a history of a definite injury or some long continued trauma to this particular joint.

The question of whether injury can cause an aggravation of an already existing arthritis is one that requires considerable study. One must distinguish between the acute symptoms that would naturally follow an injury to any joint whether arthritic or not, and the more lasting symptoms that might indicate that the course of an already existing arthritis had been accelerated.

Blencke[5] believes that injury may aggravate an already existing arthritis and that this may occur with a less severe injury than is necessary to produce arthritis in a normal joint. Engelhardt,[8] however, states that the same fundamental factors are present as in the case of a normal joint and that the injury must be just as severe as if the joint were normal. Zollinger[30] also believes that arthritis can be aggravated by trauma but that one must differentiate carefully between temporary acute painfulness and permanent aggravation. Sonntag[27] and Graessner[16] are of the opinion that the injury must be of such magnitude as to be sufficient to cause arthritis in a healthy joint.

One must be very exact in considering the previous state of the arthritis in order to judge if the disability has increased. A number of follow-up examinations over a period of a year or more may be necessary in order to determine whether there is any increase in the permanent disability. In many cases there will be an acute syndrome with swelling of the joint, pain, limitation of motion, and muscular atrophy which, however, clears up after varying periods of time and leaves no appreciable increase in disability.

DISCUSSION

From the results of the experimental work and the clinical opinions quoted above, it is quite evident that certain pathological changes in and around joints may follow injury. The relation between these changes and hypertrophic arthritis is, however, not so clear cut. There is considerable question as to whether these changes should go by the name of traumatic arthritis inasmuch as the word arthritis is associated in the popular mind with a chronic progressive disabling malady affecting the entire body. The reaction of a joint to injury, on the other hand, is usually a local condition and is more or less stationary in its development after a varying time interval. We raise the question of whether it would not be better to call these joint reactions which follow injury by some such name as chronic traumatic joint reactions unless we are willing to admit that trauma is the principal etiological factor in hypertrophic arthritis. However, in view of the generally accepted use of the term "traumatic arthritis," we have employed it in this communication.

It has been shown that these arthritic-like changes can be produced by either a single severe injury or by repeated lesser injuries. These may be produced by injuries such as intra-articular fractures, dislocations, injury to the cartilage or even to the soft parts. A good example of the pathology produced by chronic mild trauma is that of baseball pitcher's elbow as reported by Kreuscher.[22] At operation he found changes very similar to hypertrophic arthritis. There was cartilaginous destruction combined with osseous proliferation and partial fixation of the joint.

Many authors believe that injury to cartilage is the underlying change in the production of traumatic arthritis and that the injury must be severe enough to produce cartilaginous injury if it is to be followed by traumatic arthritis. Arthritic changes, however, do not always occur when cartilaginous damage is produced and in those cases where immobilization is an added factor the process is much slower and there may be restoration of the original condition. This led Burckhardt[7] to the conclusion that hypertrophic arthritis is due to regeneration after cartilaginous injury and is modified greatly by use or disuse of the joint.

The minimum time interval between injury and the development of the so-called traumatic arthritis has been given as four weeks. This, however, seems questionable and the usual time interval will be found to be from three to six months, and may be one year or longer. Many factors enter into this and it is difficult to lay down any definite time limit. It should be stated, however, that arthritis occurring several years after injury, with a long intervening normal period, should be looked upon as probably of non-traumatic origin and other causes should be sought.

In comparing hypertrophic arthritis and traumatic arthritis, one must remember that the word trauma as used here is a broad term and applies to mechanical injury and also to that more intangible form known as toxic injury. The mechanical form of injury may be a single severe injury which may or may not have been disabling at the time, or it may refer to static stresses and strains which produce long continued minor traumata to the joint. Evans[9] points out that many of these undue stresses are produced by bodily conditions such as bad posture, obesity, and abnormal bodily metabolism. The spine is especially liable to show the effects of such types of strain, but unfortunately, the same roentgen findings are present in cases of hypertrophic arthritis of the spine, except that in hypertrophic arthritis they are likely to be more generalized. It is quite evident that hypertrophic arthritis and traumatic arthritis are similar roentgenologically, and that to differentiate them one must have recourse to the history and physical examination in addition to the films.

In the experimental work reviewed above the results are fairly constant and show that following a certain standard injury one may expect typical joint reactions in most of the animals. However, when one attempts to evaluate industrial injuries many complications are encountered. The injuries are varied and range from those which appear, on the surface, to be figments of the imagination to those which produce marked structural deformities. One must also consider the previous state of health especially from the standpoint of joint disability. A very careful history and complete physical examination, including the spine, are necessary. The roentgen examination, of course, is of paramount importance because by means of it the various changes can be shown which anatomically determine normal or disturbed function of the part. In a typical case of hypertrophic arthritis the pathology represented is that of cartilaginous destruction, increased density of the articular surfaces with marginal osteophytes, and thickening of the periarticular structures. These pathological changes are delineated more clearly on the roentgen film than by any other means at our command. One must be extremely careful about interpreting these physical changes into clinical symptoms as it is a well-known fact that many cases have been seen who have had these changes to a rather marked degree without experiencing any noticeable disability or subjective symptomatology. From a medicolegal aspect, there are various criteria which must be considered. If a joint disability is to be considered of traumatic origin, then an injury severe enough to produce cartilage damage must have been applied directly to the joint in question or it must be shown to have been caused by articular stress from structural deformity elsewhere. Proof of adequate injury must exist as all factory workers receive minor traumata. Generalized bodily injury is not considered an etiological factor in traumatic arthritis.

Zollinger[30] is skeptical as to the prevalence of traumatic arthritis and makes the pertinent remark that workmen always develop arthritis from injury while housewives develop it in the ordinary course of work without a history of injury. In his clinic, out of 124,000 cases with the same type of injury, they were able to establish a relation between trauma and hypertrophic arthritis in only 18 cases.

Before making a diagnosis of traumatic arthritis, it would seem that certain criteria should be complied with and these might be summarized as follows:

(1) There must be proof of injury and of its severity.

(2) The injury must have been applied directly to the joint in question.

(3) Information must be obtained as to the previous function of the joint in question.

(4) The time interval between injury and occurrence of pathological changes must be within the generally accepted limits.

(5) There must be clinical and roentgenological evidence of pathological tissue changes.

The question of aggravation of an already existing arthritis by trauma is one in which there is not at present a uniformity of opinion. It is generally accepted, however, that an injury of such magnitude as to produce arthritis in a normal joint will cause aggravation in one already showing arthritic changes.

Considerable care must be taken to distinguish between acute painfulness of the joint after injury and the more permanent changes that might indicate exaggeration of previously existing changes. In estimating disability one must determine how much disability existed before injury occurred, and compensation paid only until the previous state of use of the joint has been restored.

The roentgenologist is in considerable demand as an expert witness in cases such as these, and in fairness to himself and the contending parties, should not allow himself to become involved in the non-roentgenological aspects of the case unless he is also a qualified clinician and has had the opportunity to thoroughly examine the patient. He should be able to state, from the study of his films, whether there are tissue changes present, such as are seen in cases of arthritis, bone reactions from injury, or deformities which might cause impairment of function. In cases which are negative for any evidence of bone or soft tissue change, he is justified in concluding that there is no roentgenological evidence of impairment of function. This does not mean to imply, however, that there may not be pain with disability in cases with slight changes. Fisher[14] states that "it is impossible to estimate the probable severity of pain and other disability from the degree of osteo-arthritis present." He believes, moreover, "that in the absence of clinical signs and with an equivocal x-ray, a diagnosis of osteo-arthritis should only be made with the utmost diffidence; secondly, that in any given case x-ray evidence of osteo-arthritis combined with an absence of clinical signs are insufficient grounds for a ruling of total disability." It is evident, therefore, that the clinical aspects are extremely important and must always be evaluated in determining the amount of actual disability in these cases.

SUMMARY

1. Injury of sufficient severity to produce damage to cartilage is often followed by chronic tissue changes which are called traumatic arthritis.

2. It is difficult to distinguish these changes on the roentgenogram from those seen in cases of hypertrophic arthritis.

3. These joint reactions after trauma usually occur from three to six months after injury, but may be delayed for a year or more.

4. Aggravation of a pre-existing arthritis by trauma is to be assumed only after injury of sufficient intensity to cause changes in a normal joint.

5. Criteria for diagnosis of traumatic arthritis are outlined.

6. Consideration is given to the medico-legal aspects of the subject.*

* For discussion see page 49.

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LOCAL BONE ATROPHY*

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ATROPHY of bone may be general or local. General bone atrophy is chronic in character and affects the entire skeleton. It is caused by a lack of calcium in the food or by some abnormality in the calcium metabolism. Local bone atrophy may be acute or chronic and involves only the bones in a given portion of the body and is due to some local cause, and occurs in animals on an adequate calcium intake and with a normal calcium metabolism.

The atrophy is said to be eccentric when the bone is approximately normal in size and concentric when the bone is smaller than normal. The marrow canal of a long bone is increased in diameter in eccentric atrophy and is decreased in diameter in concentric atrophy. Eccentric atrophy is the result of resorption of part of the bone and in a long bone the cortex is not as thick as normal. Concentric atrophy is the result of retardation of growth and is caused by prolonged eccentric atrophy in a growing bone. In a long bone with concentric atrophy the thickness of the cortex depends upon the recent functional past of the bone. If the bone has been subjected to approximately normal use the cortex will be thick, but if the bone has been used relatively little the cortex will be thin.

It is further to be noted that eccentric atrophy is a temporary condition and the bone tends to return to normal after the cause of the atrophy ceases to act, but that concentric atrophy of any considerable degree tends to be permanent and if a growing bone is permitted to remain atrophic over a prolonged period so that growth is definitely retarded, it will tend to remain small throughout the life of the animal and, if the cause of the atrophy ceases to act, nature will attempt to compensate for the small size of the bone by increasing the thickness of the cortex.

ATROPHY OF DISUSE

To the physiological chemist the skeleton is the great calcium reservoir of the body, but to most of us the bones are the supporting structures which give strength and rigidity to the body, and their chief function is passive in that it consists of resisting mechanical forces. Generally speaking, function within physiologic limits, alternating with periods of rest, tends to cause a living organ to increase in size while lack of function tends to result in atrophy. Consequently, if a bone is not subjected to mechanical forces its function is lessened and we would expect the bone to atrophy from disuse.

As yet we have no satisfactory explanation as to why a bone which is not used tends to become resorbed. We do not even know whether the change in the bone is the result of increased resorption or of decreased formation of new bone. In order to view the problem in its proper perspective we must consider briefly the part which the skeleton plays in the metabolism of calcium. As a certain amount of calcium is excreted this calcium must be obtained from the food if calcium equilibrium is to be maintained. Sherman has shown that the normal adult human being requires 0.45 gm. of calcium daily and if this amount of available calcium is not present in the diet the calcium balance becomes negative. That is, more calcium is excreted than is ingested. This excess of calcium is withdrawn from the skeleton and this element can be withdrawn from the bones whenever needed by the general metabolism and is withdrawn whenever the calcium balance is negative. It is thus evident that a negative calcium balance leads to progressive generalized bone atrophy and if it were possible to maintain an animal on a negative calcium balance long enough the bones would

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tend to become completely decalcified.

If our histological criteria are reliable we may assume that even in an adult animal in a state of calcium equilibrium some resorption and some deposition of bone are constantly going on. This means that some of the ingested calcium is deposited as new bone, while some of the excreted calcium is withdrawn from the bone. There is thus a constant exchange of old for new calcium by an animal in a state of calcium equilibrium. It is, however, not possible to state whether a large or a small percentage of the ingested calcium is thus exchanged. Nor have we discovered how this exchange is regulated. The chemist would naturally expect this exchange to be regulated by chemical reactions and chemists have sought in vain for a satisfactory explanation of either the resorption or the deposition of bone in an adult animal in a state of calcium equilibrium.

Likewise, there is no satisfactory chemical explanation of the local atrophies which orthopedic surgeons are constantly encountering in their patients. Since no satisfactory chemical explanation is at hand we must assume that the deposition and resorption of bone depend upon the activity of living cells and that these cells can react to mechanical forces. We do not know how the exertion of mechanical force upon a bone can serve as a stimulus to the cells which control the formation of new bone, but experimental and clinical evidence indicate that new bone is formed in response to mechanical stimuli and is not formed in normal tissues if the mechanical stimuli are absent.

The evidence at hand also indicates that some bone resorption is constantly going on even in a normal adult animal on a normal diet. If it is true that new bone is not formed in the absence of mechanical stimuli, then atrophy of disuse may be simply the result of the normal bone resorption, since the maintenance of a normal bone structure depends upon an equilibrium between the normal rate of resorption and the deposition of new bone. However, it is quite possible that disuse results in an increase in the rate of resorption and microscopic observations on bones which are undergoing atrophy from disuse suggest that this may be true.

The degree of the atrophy varies directly with the degree and duration of the inactivity, and Grey and Carr[4] and Allison and Brooks[1] have shown that so far as the bone is concerned it makes practically no difference whether the inactivity is due to enforced rest in a plaster-of-Paris cast or to muscle paralysis and that the presence or absence of sensory nerves to the part does not influence the condition of the bone.

The mechanisms by which this resorption is accomplished have been discussed elsewhere (Key[5,6]) and will not be repeated here. Suffice it to say that halisteresis does not occur in local bone atrophy and that the resorption is largely lacunar in type and that the lacunae contain osteoclasts. In atrophy of disuse the entire bone suffers and there is a gradual decrease in the size of the trabeculae and in the thickness of the cortex. As the atrophy continues to progress many trabeculae disappear entirely and the cortex may eventually become as thin as a sheet of heavy writing paper. This is not in accordance with the findings of Bauer, Aub, and Albright[2] who found that the bone trabeculae disappeared first and that the cortex suffered relatively little. However, the atrophy studied by these authors was due to lack of calcium in the food while the atrophy which we are considering is due to disuse and occurs regardless of the amount of calcium supplied to the organism. The discrepancy between their observations and the findings in both experimental and clinical atrophy of disuse may be explained by the fact that their animals were constantly using their extremities. As a result, that part of the bone was resorbed which could be spared while the cortex, which was being subjected to the mechanical forces incident to normal use, remained almost intact. This may be explained by assuming that function caused new bone to be formed in the cortex to re-

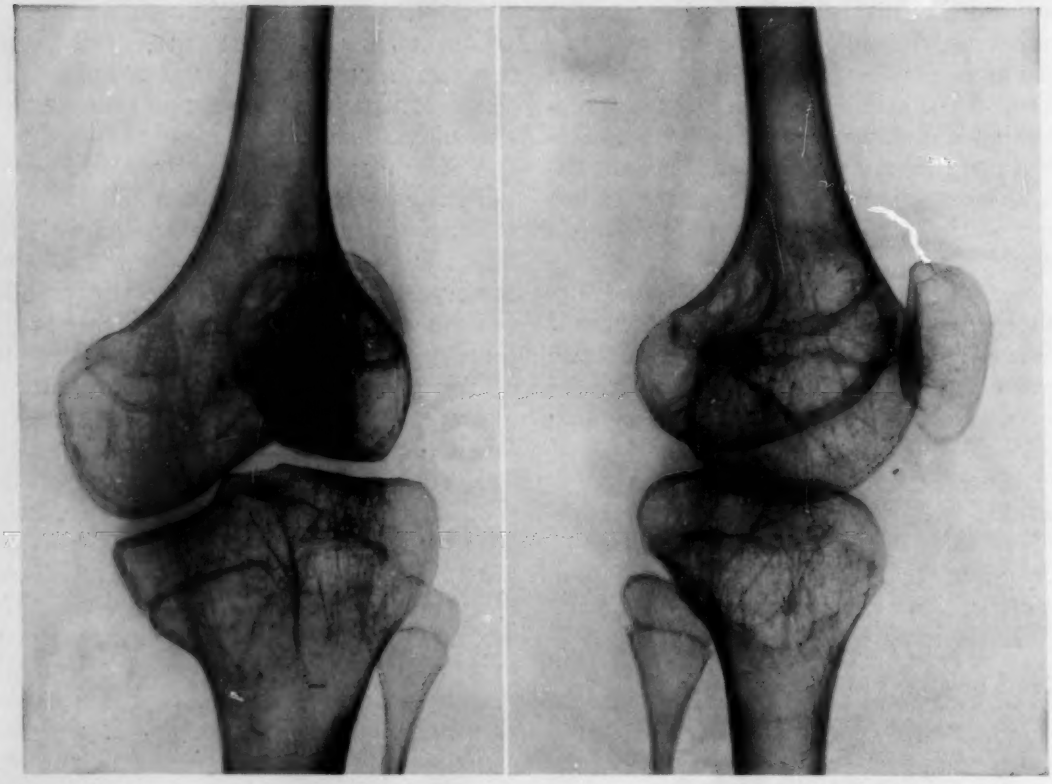

FIG. 1. Extreme concentric atrophy of disuse at the right knee joint in a girl sixteen years of age. This patient had spent the past four years in a tuberculosis sanitarium on a high calcium diet with this extremity immobilized by traction.

place that which was resorbed. If this occurred we should expect the shafts of the long bones to be stained with madder. But in their experiments the shafts of the long bones were stained very slightly. Consequently, I interpret their results as evidence that function tends to prevent resorption of bone even when the animal is on a negative calcium balance and that atrophy of disuse is probably due to increased resorption plus decreased new bone formation.

In the roentgenogram simple atrophy of disuse is first visualized as a diffuse decrease in the density of the involved bones. This is especially evident in cancellous bones and in the ends of long bones. As the rarefaction progresses the trabeculae stand out more clearly and the dense areas of the bones decrease in size. With further atrophy changes in the cortex become visible and the trabeculae decrease in number so that the intertrabecular spaces become larger than normal. This is due to the gradual disappearance of many trabeculae. With extreme atrophy the cortex becomes progressively thinner and the trabeculae largely disappear so that a bone may appear as a faint shadow surrounded by a very thin cortical line enclosing a relatively small number of very faint trabeculae (Fig. 1). In simple atrophy of disuse there is no tendency for marked resorption to occur in localized areas and the mottling which occurs in acute atrophy is not seen.

ACUTE BONE ATROPHY

Acute bone atrophy may be divided into two groups: In one the atrophy occurs as a result of local inflammation or injury and

tends to disappear as soon as the cause is removed. The other is the so-called acute traumatic bone atrophy of Sudeck, and in this type the atrophy occurs after an injury and tends to persist over a considerable period of time.

The acute atrophy is partly due to disuse because the inflammation or injury interferes with the function of the part. However, observations on experimental animals and human subjects indicate that the bone atrophy progresses much more rapidly in injured or inflamed limbs than it does in normal limbs which have been paralyzed or immobilized in a plaster-of-Paris cast. These observations also indicate that the atrophy progresses more rapidly in acute infections than in chronic infections and in severe injuries than in minor injuries.

Fig. 2*a*. Marked acute atrophy due to gonorrheal arthritis, duration three months.

Fig. 2*b*. Same as Figure 2*a*. Anteroposterior view. The arrow points to what appears to be a deposit of calcium in the soft tissues.

As yet we have no satisfactory explanation for this rapid resorption of living bone in the vicinity of an infection or injury. It is usually ascribed to the local increase in circulation which is brought about by the injury or infection. However, it can be accepted that thoracic or lumbar sympathectomy causes an increase in the circulation in the affected extremity; yet I was not able to detect bone atrophy in the sympathectomized limbs of a series of cats upon which Dr. Robert Moore and I had performed these operations. The same ar-

gument holds against local heat as being responsible for the accelerated bone resorption because sympathectomy causes an elevation of the temperature in the affected limb; yet I have some experimental evidence which indicates that local heat may increase the rate of atrophy of disuse. It is possible that acute bone atrophy is due to some unknown chemical change in the tissues.

FIG. 3. Acute atrophy in mid-tarsal region due to nonsuppurative arthritis of unknown etiology, possibly low grade streptococcic infection. Duration eight weeks.

A familiar and very striking example of acute bone atrophy is that which occurs as a result of gonorrheal arthritis. With an acute gonorrheal joint the bone resorption occurs very rapidly and a roentgenogram taken four weeks after the onset usually shows marked rarefaction of the ends of the bones entering into the formation of the involved joint. This is especially true of those cases in which the disease is accompanied by edema of the periarticular tissues with marked tenderness, pain and local heat (Fig. 2). The same is true of an acute pyogenic joint or of a fulminating pyogenic infection of the bone or in the soft parts around the bone. One occasionally sees an acute arthritis which is apparently infectious in nature and the clinical picture of which resembles very closely gonorrheal arthritis and in such cases we find the same type of acute bone atrophy as occurs in the acute gonorrheal arthritis (Fig. 3).

Tuberculosis of bones and joints usually begins insidiously and progresses slowly. Consequently, the local bone atrophy, which is regarded as the earliest roentgenographic evidence of this disease, tends to progress slowly. However, in certain acute, fulminating tuberculous joints the bone atrophy may progress rapidly and be comparable to that which occurs in an acute pyogenic infection. As the disease may continue over a period of years and imposes long periods of disuse upon the extremity the bone atrophy may be extreme. Much the same is true of the bone atrophy which is such a prominent feature in chronic atrophic (rheumatoid or proliferative) arthritis.

FIG. 4. Acute atrophy present three months after a severe compound fracture of both bones of the leg. This patient has been in a plaster-of-Paris cast during this period.

In fractures the bone atrophy is largely the result of the disuse incident to the injury, but it is often acute in type and more marked than one would expect to occur from simple immobilization (Fig. 4). The acute bone atrophy which follows freezing or burning of an extremity resembles that which follows fractures and is probably due to the injury and infection rather than to any specific effect on the bone.

Roentgenographically, acute bone atrophy differs from the simple atrophy of disuse in that it is more sharply localized to the area immediately adjacent to the in-

fection or injury and in that it is less uniform in character. The bone frequently contains circumscribed areas of rarefaction in which the resorption has been greater than in the surrounding bone. This gives the bone a mottled appearance. This mottling is evidence of acute atrophy and in most instances occurs in the relatively early stages. Usually the roentgenogram is foggy or hazy and the outlines of the bones are not sharply defined. This is due to the local edema and thickening of the soft tissues which are usually present in acute bone atrophy. Very rarely small opaque masses may be present in the soft tissues and the roentgenogram suggests that calcium salts may have been withdrawn from the bone and deposited in the adjacent soft tissue (Fig. 2). After the atrophy has been going on for a relatively long period of time and the resorption is very marked the atrophy becomes diffuse and the roentgen picture resembles that of prolonged simple atrophy of disuse.

ACUTE TRAUMATIC ATROPHY OF SUDECK

This is a rare condition which is usually called Sudeck's atrophy because it was first adequately described by him in 1900.[7] It may occur after a severe injury or it may occur after a minor injury such as a sprain or contusion of the knee or ankle. After the injury the joint involved and the parts distal to it remain cold, cyanotic and painful. There is marked limitation of motion of the joints and this limitation of motion may be progressive. The roentgenogram shows an acute atrophy of the bone such as was described above and this may be well marked within a period of four weeks after the injury. This type of atrophy may persist over a period of many months, and lead to great disability and to eventual ankylosis of the involved joints. Sudeck believed that the acute atrophy was caused by some reflex neurotrophic phenomenon. A discussion of the various theories which have been advanced in an attempt to explain Sudeck's atrophy is given by Beck,[3] but as yet we have no satisfactory explanation of the condition (Key[5]).

CONCLUSIONS

Chronic local atrophy of bone may occur from disuse and is not due to or markedly influenced by the calcium intake or calcium metabolism. Acute local atrophy of bone is the result of disuse plus some as yet unknown local factor.*

* For discussion see page 49.

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THE ANATOMICAL BASIS FOR DISTURBED FUNCTION IN EVALUATION OF PERMANENT DISABILITY*

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THE enactment of workmen's compensation has introduced new social obligations for the physician. In addition to the management and treatment of accidental injuries he must prognosticate the effects of those injuries on the earning and working capacity of the injured. These prognostications must be translated into mathematical percentages, since the compensation paid to the injured is based on these percentages.

The determination of the percentage of permanent disability following industrial accidents is an important function of the medical adviser to the Workmen's Compensation Bureau. The amount of compensation that the injured worker receives depends upon these estimates. These determinations must be made by the examiner in the larger number of cases, since the schedule rating in the law provides only for absolute disabilities such as complete paralysis or blindness, cases of amputation, or total loss of use of a member. The partial disabilities which form the larger number of cases are not described in the law, and it is the task of the examiner to determine the disability resulting from these injuries.

It is the usual procedure in most compensation courts and commissions to have several physicians in the same cases estimate differently, and they often show discrepancies from zero to 100 per cent. In a recent case of a young woman with a fracture of the upper third of the femur with some shortening and limitation of the motion of the knee, some disturbance of gait, the attending physician who treated her estimated a disability of 80 per cent loss of use of the leg; the insurance physician estimated 40 per cent; when the attending physician was asked just why he estimated 80 per cent, he replied, "For the same reason that the other physician estimated 40 per cent; as a matter of fact, we are both guessing."

The methods in use throughout the United States differ greatly. Earning capacity, vocational utility, structural defect, cosmetic impairment are all given consideration in the different methods of rating. No universal standard has been accepted although I have long advanced the recommendation that only functional disability should be used as a basis of determining disability.

I believe that functional loss is the most readily adapted criterion and basis for estimating disability, because it can be used for the purpose of measuring. And since we are asked to measure, here is something with which to measure. What can a limb do? How far can it move? One can see just how far the arc of movement is impaired. One can determine how far average muscle power is impaired. One can ascertain just how far coordination has been interfered with.

Now the word "function" requires a little definition. Here again we may not all be meaning the same thing when we say function. Function to one may mean motion; to another it may mean coordination and it may also mean power, and to still a fourth it may mean the summation and the resultant of these three factors.

If we take an extremity like the arm and define function, we will define it in these three physiological terms: movement of the joints, power of the muscles and coordination and control from the brain through the peripheral nerves.

A man with a very mild weakness in the arm following a nerve injury might have complete range of motion, yet due to the

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marked impairment of power and impairment of coordination may be handicapped. Where joint motion is limited but a fairly good arc of movement is retained, the injured worker may have much more power than others with even less limitation of motion.

Any type of arthrometer which is fairly accurate should be used to measure range of motion. For measuring strength we find that the older method of using the spring dynamometer is not very accurate because it depends upon the voluntary control of the patient. We find that it is very inaccurate, because if there is no cooperation on the part of the patient he can give you as little or as much as he wishes. Furthermore, in testing out a large number of individuals, I have found such a wide variation that in one man who was practically moribund and who was suffering from extensive generalized tuberculosis with amyloid changes of the liver and spleen, I obtained the highest reading, while a truck driver gave me the lowest reading. Neither of these was a compensation or a litigation case. We have had recourse to the Martin spring balance for our use. In 1916 this balance was used by Martin and Lovett in examining a large group of cases of infantile paralysis and they found it very effective, because it can be used to a large extent without expecting a great deal of cooperation on the part of the patient. By that I mean that it is used in such a fashion that it registers the resistance of muscle pull rather than a voluntary movement of muscle.

Tests of coordination are many and varied. The psychologists, for the most part, have developed them. For a long time I, too, was under the illusion that a right-armed man had a stronger arm in the right side than the left, but I have learned since that it is not so much strength that causes the difference between the two, but a difference in coordination. The ability of a prize fighter to hit a target, his opponent on the chin, with the right arm is due not so much to strength as it is to coordination. There are a great many tests for determining this peculiar aptitude or attribute. A very simple one is a peg hole test which depends upon the individual placing 28 or more little pegs in holes with one hand and counting the time and comparing it to the other hand.

With the use of apparatus to measure the range of motion of the joints of the arm, the power of the muscle groups and coordination, we now proceed to the determination of functional disability. The upper extremity is divided into two units or radicals, the arm unit or radical and the hand unit or radical. The functions of these two units are essentially different. That of the arm radical may be compared to the action of a compound lever, permitting the hand radical or grasping tool to gain access to objects.

Motion, power and coordination are determined for the arm radical in the following way. The arm is divided into three major joints: shoulder, elbow and wrist. We ascribe arbitrarily a value of 33 1/3 per cent to each joint. We do not know—it is impossible to know, except for specific vocational purposes—what the relative value of each joint is. We therefore have to resort to more or less arbitrary principles in establishing a value for each joint. Let us say that the shoulder is restricted one-half its normal range. We ascribe, therefore, a value of one-half of 33 1/3 per cent, or 17 per cent. This 17 per cent represents the loss of motion for the arm radical.

The loss of strength is measured by the spring balance and is found to be 11 per cent and loss of coordination to be 7 per cent.

Now, again, we do not know which of these functional factors is most important and we do not know whether they ought to be added or multiplied. We utilize the largest factor of functional disability as a factor of disability for the entire arm radical, and in this particular instance it will be 17 per cent.

In evaluating the function of disability of the hand we realize that the hand is very

much like various types of tools. By the action of the thumb against the fingers the hand simulates the action of a pair of pliers.

Again, the function or physiological action of the hand and fingers may simulate that of a ring.

The apposition of the thumb to the index finger simulates the action of a pair of forceps, with its fine movement.

And, finally, in the carrying of objects in the folds of the fingers the hand simulates the action of a hook.

So we have these four mechanical analogues. However, we can still further translate these mechanical analogues into three definite functions of the hand: (1) the grasping power for small objects between the folds of the fingers themselves; (2) the grasping power for large objects between the fingers and the palm; (3) the apposition between the thumb and the tips of the fingers. Here, too, we ascribe a value of one-third to each function. If a man is unable to grasp an object between the folds of his fingers, we immediately ascribe a disability of 33 1/3 per cent of the hand. If he has also lost the ability to grasp large objects between the flat surfaces of his fingers and the palm, that is another third, or two-thirds. And if he is unable to oppose the thumb to the tips of the fingers, that very important function of apposition, then he has lost the other third.

Let us assume we have a case of a fractured head of the radius with poor position. We find the arm radical, that lever portion of the upper extremity, is disabled to the extent of 24 per cent. That 24 per cent may be due to impairment of power or impairment of motion, most likely motion in the elbow joint, yet the hand radical is not impaired to any extent; motion of the fingers is unrestricted; ability to grasp large objects in apposition is unrestricted; therefore, the hand radical is not involved. We then ascribe a disability of the entire arm of 24 per cent. We proceed on the theory that the chain is as strong as its weakest link; in this particular case the arm radical is the weakest link, and is disabled to the extent of 24 per cent.

We may have a Colles' fracture with a poor reduction. The arm radical, as far as the wrist motion goes, may be impaired only 12 per cent. The hand radical, due to some flexion involvement with resultant inability to oppose objects between the folds of the fingers adequately, is disabled much more than the arm radical. We do not add these two values. We ascribe a value to the entire extremity equal to that of the greatest disability of the two radicals, or 20 per cent.

In the case of a compound fracture of the elbow with involvement of the ulnar nerve, there may be limitation of motion equivalent to 18 per cent. The hand radical due to sensory disturbance, contraction deformities of the last two fingers, probably paralysis of the extensor muscles of the hand, atrophy and weakness may give a 40 per cent disability of the hand radical. Here, too, we take the larger disability of the two as the one for the entire extremity.

In a fracture of the metacarpals with poor position and some shortening, the arm radical has no disability, no limitation of motion in the shoulder, elbow or wrist. There is no gross involvement of the power of the shoulder, arm or forearm muscle group, and there may or may not be gross involvement or coordination of the upper and forearm muscles. But the hand radical is definitely impaired due to the fact that there is some inability to grasp objects between the folds of the fingers.

Head injuries, back injuries, chest injuries and all other injuries, with the exception of the extremities, are very difficult to estimate. Yet they, too, must be computed if the injured man is to get his just award.

We have found another way of determining that man's physiological disability. We determine that disability through the use of a workshop where these men are put to work at various processes from the very lightest processes to the heaviest of operations. The shop is fitted out as a carpentry

shop, with a great many other activities. We have printing, show card writing, looms, flower making and several other items. The injured workers start in at seated occupations, using an ordinary coping saw, cutting out stencils, the lightest sort of occupation that any individual can do if he has the use of his hands and is able to get to a place. We arbitrarily appraise a disability of an individual in accordance with the type of work that he can do. If he is only able to go to this first process and not go on to the second or third process, we consider his disability two-thirds of the total. We feel if he can do this, he has, at least, one-third functional vocational capacity.

The next mechanical process is a little more difficult. The man has to stand at a work bench and use a file, hammer and saw, work which varies from light to moderately heavy operations. We call this standard practice.

And, finally, he has to do the third type of work, the hardest kind of carpentry, climbing up and down ladders, and using a hammer, saw, nails and file—on the heaviest kind of work projects.

Regardless of the part of the body involved, physiological utility can be used as a measure of disability. For example, function in the upper extremity is expressed in the factors of motion, strength and coordination which can be measured. Weight bearing is the chief physiological function of the lower extremity. In endocrine disturbances like diabetes it is the carbohydrate metabolism that forms the functional basis for the determination of permanent disability. In nephrectomy it is the remaining kidney function which is utilized as a basis for determining the compensation that is to be paid.

The structural changes resulting from accidental injuries show no consistent or direct correlation with the functional disability.

A severe fracture deformity may be accompanied by little or no functional disability; while a minor structural change may occasion a severe functional disability. This is due to the fact that the body economy contains a safety factor in the presence of disease. The body must maintain its normal function or it dies. It continues to operate by having extra resources to call upon both in structure and function. Through self-repair, regeneration, hypertrophy dependent on new conditions, vicariousness of function, the body combats its environment.

The end-results of industrial accidents, therefore, should be appraised not on the basis of structural changes but on disturbed function.

The conservation and protection of our man power depends on the concept of the worker as a social and economic unit. Because of the accident hazards of industry, it is necessary to preserve this man power by proper health and accident safeguards. Where safeguards are inadequate and injury occurs replacements for reduced earning capacity should be made in the form of *compensation* awarded on a rational basis. Where compensation is inadequate to reestablish the worker as an independent economic unit, he should be rehabilitated and restored to remunerative employment through physical and vocational re-training.*

* For discussion see page 49.

TRAUMATIC NEUROSIS*

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THE term traumatic neurosis has been a most abused term during the past few years for it has been used indiscriminately to cover all conditions following injury that cannot be accounted for on an organic basis. The term itself is a poor one, especially in industrial medicine or in the legal phase of medicine because the word traumatic immediately causes prejudice. Some authorities have suggested the use of the diagnosis "neurosis following injury" in cases of so-called traumatic neurosis until it has been definitely decided whether or not the neurosis is the result of the injury of whether it merely appeared after the accident without having any relationship. This, I believe, is a much preferred diagnostic term.

We are all aware of the increase in the frequency of neuroses associated with injury. This is due to a number of factors. The most important of these are lack of employment, the ever increasing speed of factory work with a resultant driving of employees, fear of losing position, and avarice that later changes from malingering to a true neurosis.

To arrive at a diagnosis of neurosis following injury should offer no great difficulty if we adhere strictly to the definite signs of a neurosis. It is not just to say that any complaint a patient has and cannot be accounted for on an organic basis is a neurosis. Such a practice encourages malingering and also makes it difficult for the person with a true traumatic neurosis to obtain what is due him. The signs of a neurosis following injury are emotional instability, such as weeping attacks and depression, vasomotor disturbances such as flushing and dermographia, increased tendon reflexes, fine tremor of the hands, increased electrical excitability of the skeletal muscles, trophic changes, fast thready pulse and an attitude of despair. I do not mean to give the impression that all of these signs are necessary for a diagnosis but a sufficient number should be present to exclude any element of doubt.

Of course, the best way to combat the increasing incidence of neurosis associated with injury in employment is to attack it from the preventive side. Industry, itself, can be of great help in this without a great deal of effort. The employer should take an accurate employment history of a prospective employee before he is hired to determine whether or not he is fit to do factory work. The worker who changes his place of occupation frequently and the nature of his work frequently without advance is not the desirable kind. The employee who does this usually finds it difficult to adjust himself to any fixed environment and is very prone to develop a neurosis at the slightest provocation. The examining physician should also note whether or not there is any evidence of emotional instability and also if the prospective employee is hypersuggestible. The employer should make every effort to give the employee a pleasant environment in which to work which is most easily obtained by having foremen who do not constantly antagonize the men below him. The medical attendants, especially the first aid men, must be careful what is said in the presence of the injured immediately after an accident because during this period fear is quite marked and remarks such as, "If it had struck him one inch further down he would have been a goner," have their effect. During any emotional reaction one is unusually suggestible.

After the diagnosis of a neurosis has been made, the next step is to determine whether or not the neurosis is related to the injury. This necessitates observation of the

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case for a period of time. During this period a complete investigation must be made of all the phases of the patient's life, other than industrial, in an effort to uncover some other situation that has been the precipitating factor. This is extremely difficult because of the fact that a neurosis is primarily a defensive mechanism, not against doing work, but against life in general to which he has found difficulty in adjusting himself. The defensive mechanism together with a tangible concrete cause fixed in the patient's mind, namely, the accident, offers a large obstacle to overcome. It usually results in the patient having a mental block against any unravelling of his subconscious mind. As a result, considerable time is necessary to make any appreciable headway.

The real origin of the neurosis aside from the injury may be purely avarice, which may be encouraged by friends, relatives and attorneys, or it may be a fear produced by a wrong medical diagnosis as well as a situation far remote from the accident. In regard to avarice, it should be remembered that symptoms may begin as pure malingering but later change to a true hysteria or neurosis through suggestion.

In the differential diagnosis of traumatic neurosis, we must consider most of all, true hysteria, post-concussion syndrome, and malingering. Hysterical pains, paralysis, contractures, etc., differ from traumatic neurosis in that the emotional instability is practically negligible, tremors and increased tendon reflexes are not present and vasomotor disturbances are rarely present. The usual picture in hysteria is a localized complaint that is purely ideogenous and rarely is there any generalized reaction. This, with the stigmata of hysteria, suffices to differentiate the two conditions.

The post-concussion syndromes are easily differentiated by the nature of the complaints, namely, headache, head noises, attacks of dizziness and occasionally increase in the spinal fluid pressure with relief of symptoms following a spinal drainage. Encephalography is also helpful in diagnosis.

Malingering, of course, offers the greatest problem in the differential diagnosis of a neurosis in industrial and legal medicine. As I stated above, if the signs of a neurosis are strictly adhered to for a diagnosis, the question of malingering will arise most infrequently. In those cases in which there is doubt regarding the genuineness of the symptoms, the claimant must be closely observed throughout the day for evidence of malingering. Placement in a sanitarium may be necessary for this procedure. I, personally, satisfy myself by not considering any case one of traumatic neurosis unless conclusive signs are shown because a neurosis is an entity and the borderline cases are usually the ones who have either begun as malingerers and through suggestion have produced certain functional disturbances in themselves or are malingerers at the time of the examination. I believe that the medical profession should be out of sympathy with any case in which there is a definite conscious element.

The treatment of traumatic neurosis is a most difficult problem, especially in industrial medicine, because of the compensation that is received and the length of time a case is usually allowed to go before a diagnosis is made. An early diagnosis and settlement are absolutely essential if good results are to be obtained. To allow a case to become long standing will tend to encourage any symptoms that may start as malingering to change over to a functional disturbance. The periodic check from the employer or his insurer in a bona fide case is the same as handing him a note saying he is still incapacitated. So an early diagnosis and complete and final settlement are the two most necessary points before instituting other forms of therapy. In spite of a lump sum settlement, there are some cases that do not improve, even though the most careful treatment has been instituted.

Case. F. S., aged sixty, was examined on August 11, 1932. The previous medical history, family history and marital history were entirely negative and had no bearing on his complaints, which consisted of pain in the right

shoulder, difficulty in the use of the right upper extremity and pain in the right side of the head. He alleged that these complaints had persisted ever since he was jammed between a door and wall on May 5, 1931, while employed by a lumber company. He was placed on physiotherapy, treatments being given at intervals of two to seven days until April 6, 1932, when he was denied further compensation. Compensation was denied because a letter was produced which the patient had written on May 12, 1931. This letter was an application for work with another lumber company in which he stated he was able to do any kind of work.

The case was reopened because the employee filed a claim that his complaints were worse and he was then sent for a neurological examination. The examination was entirely negative for organic disease other than rather marked signs of senility. The patient was definitely depressed and showed a marked flushing of face and neck. There were numerous facial tics. The right grip was weaker than the left and all movements of the left upper extremity were limited and weak. All forms of sensation were alleged to be diminished on the right side of the body with the change in exactly the mid-line. All tendon reflexes were definitely increased and there was a fine tremor of the hands on extension.

The above signs are characteristic of a neurosis, but the concrete evidence presented left no doubt about the condition starting as pure malingering. The complaints were then encouraged by routine physiotherapy without a proper analysis of the case, with the neurosis as a result.

After litigation is completed, the treatment consists of placing the individual in an environment away from all outside influences, institution of physiotherapy and suggestion therapy and building up his confidence through a gradual increase in his daily duties. Where a case cannot be closed beyond reopening, such as is the situation in Michigan, different steps must be taken. The ideal treatment would consist in placing the patient away from his sympathetic home environment, his physician having complete charge of the case so there would be no contacts between patient and insurance adjuster, and the cooperation of the employer in helping to adjust the employee. The reason for avoiding a sympathetic environment is quite evident. To avoid contacts with insurance company representatives is to avoid the building up of defensive mechanisms against a return to work. Every time the patient has an interview with an adjuster, he is sure to be asked when he is going to return to work and will sense an antagonistic attitude. This should be avoided and, as a matter of fact, the patient should be made to feel that he is not being pushed, that a corporation has, after all, a human side. This latter is shown by making him feel that everything possible is being done through consultations for assurance, by allowing him to take a vacation if he desires, and so forth.

The cooperation of the employer in getting the patient back at work is necessary because any industrial conflicts must be removed, and, as a rule, work of a different nature must be supplied. A gradual increase in the demands is instituted, but under no consideration should he be given a type of employment that marks him a cripple. Of course, no case of traumatic neurosis will become adjusted if the individual feels that after his return to work he is to be laid off in a short while or if he feels that he is to receive some other form of punishment. This latter angle is the greatest obstacle in treating a neurosis because the patient has, no doubt, built up a defensive mechanism due to present lack of employment. A lump sum settlement of the case beyond reopening would therefore be a change most welcome to the physicians as well as to the employers and their representatives. This would would be material aid in effecting an adjustment of the patient. In closing, allow me to repeat that the problem which traumatic neurosis offers today would be greatly simplified if the term were applied only to those cases which have the classical signs of a neurosis.*

* For discussion see page 49.

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THE ROENTGEN-RAY AND MEDICAL EXPERT IN THE HEARING OF COMPENSATION CASES*

By SAMUEL H. RHOADS
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AN EMINENT English jurist has said, referring to the Compensation Law, that:

"The few and seemingly simple words 'arising out of and in the course of the employment' have been the fruitful (or fruitless) source of a mass of decisions, turning upon nice distinctions and supported by refinements so subtle as to leave the mind of the reader in a maze of confusion."

The administration of the Workmen's Compensation Law has become a highly specialized branch of legal-medical jurisprudence. The general practitioner, either in law or medicine, soon finds himself in this "maze of confusion" when confronted by the highly trained expert in either field. It necessarily means expense to employ skill in any law suit. More legal aid is perhaps given injured workmen and their dependents in compensation cases than in any other field of litigation. Because of this situation, a greater responsibility is placed on the expert. After several years on the Commission, and an examination of hundreds of cases where experts have testified, I can say that as a rule the roentgen-ray and medical expert has given his honest opinion as to the causal connection between the accident and the disability.

The human body is a very complicated and wonderful piece of creation. It has been said that a person is as old as his arteries. The heart beat, the blood pressure, and the temperature are some of the gauges which indicate to the trained mind certain conditions of the body. Medical science has made wonderful progress in diagnosing human ills and the roentgen-ray with its trained specialist has been a great aid. In fact, the roentgen ray is an indispensable aid. Certain diagnoses would not be possible without it. It has saved human life, because with it the diagnostician and surgeon are guided in their treatment and operations. But like any other science it must be under the control of an expert. The taking of the roentgenogram is important, but the interpretation is more important. In weighing the testimony in a case, the skill and experience of the interpreter of the x-ray must be taken into consideration. The ordinary physician and surgeon can discover fractures and the common abnormalities, but diseases of the bone, heart and lungs, out of the ordinary, require the services of the roentgenologist and pathologist for a proper diagnosis. It has been said that a little knowledge is dangerous. This is particularly true when it comes to the roentgen ray. The testimony of some cases, where a doctor with a limited experience has taken x-ray pictures and is attempting to interpret them, is ludicrous. Such information may mislead the Commission and lead to a miscarriage of justice.

For example, take the case of cancer. I have never yet heard a real expert say he knew the cause, but many times some physician limited in experience will express an opinion which may mislead the Commission. The Commission must follow the evidence. The end should not be to assist one of the litigants, which is often the case where the witness is not qualified in a field where he has entered, but to testify as a scientist rather than an advocate.

Traumatic neurosis seems to be a convenient place to assign the patient when no pathological basis can be found for the disability. While I realize that the mental attitude, when coupled with an accident, is an important factor, yet this alleged

* Read at the Thirty-third Annual Meeting, American Roentgen Ray Society, Detroit, Mich., Sept. 27–30, 1932.

disability of traumatic neurosis must, in my opinion, be watched very carefully. It is much overdone. In one case, a witness from a state university, a leader in his profession, testified as follows:

Q. What is a traumatic-neurosis?
A. A traumatic neurosis means the result of a person of a peculiar type of mind, the sort of a person who under strain and stress, is likely to break down, in those people injury will produce, the exaggeration of the symptoms, exactly the same as people that had shell-shock overseas.
Q. It is just as much of a disability as though it was an actual material fact, if it affects the mind that way?
A. It depends on how much it is connected with questions of litigation.
Q. With what?
A. With questions of litigation.
Q. Well in the absence of litigation?
A. You very rarely see it in the absence of litigation.

The x-ray in the hands of an expert assists the diagnostician to avoid medical absurdities. A miscarriage of justice is a legal tragedy. It strikes at the foundation of government. Such a catastrophe should always be avoided wherever possible. The x-ray should be in the hands of the roentgenologist when it comes into the field of litigation. Sometimes it is suggested that a physician as a member of the Commission would be of service. I do not think so. Better keep the judge in his place and the expert witness in his. The business of weighing testimony, expert as well as lay, and determining the facts, applying the rules of law, is the function of a judge. He constructs the eternal building of the law out of the material brought to him. If poor material is brought, the defect is seen in the structure.

The Compensation Law is complicated. It is complicated because it deals with a complicated subject. Accidents and their many phases in relation to employment, the causal connection between the accident and the disability, the human body and its attendant ailments, all of these phases lead us into fields of the most puzzling complications.

As previously stated, the medical expert, and especially the roentgenologist, is of great assistance to the Commission, in fact, an indispensable aid in many cases. But he should not leave his high calling as a scientist to assume the rôle of the advocate. The moment he commits this judicial sin, the value of his testimony as an unbiased expert is destroyed. The judge who is trained in weighing testimony and argument senses a matter of this character quickly. When he does, his confidence in the witness is destroyed. He can easily find judicial reason to eliminate the witness, and usually does so in a very noticeable manner. It is too great a price for any expert to pay for the result of any case, because he endangers his future usefulness in his chosen field. He should appear for the opposite side from that for which he usually testifies, occasionally, as a check on his mental attitude. As a judge should seek to maintain a perfect judicial attitude, remembering only the evidence and the law, so should the expert witness remember only his science.

I believe the medical and roentgen-ray experts who are testifying in cases before this Commission are doing their best to uphold this standard. The Commission will continue to have confidence in them as long as they do. The roentgen ray has great possibilities in fields yet unexplored. It has made wonderful progress in the last twenty-five years. What the next twenty-five will be we do not know, but can only imagine. Yours is an interesting science of great benefit to humanity. March on to greater achievements, and may the glory of your progress inspire you to do your best.

DISCUSSION OF SYMPOSIUM ON INDUSTRIAL AND MEDICOLEGAL PRACTICE*

Dr. E. C. Samuel, New Orleans, La. In our consideration of industrial medicine in its medicolegal aspects, we incline largely to the consequences of accidents rather than to their elimination. What is being done to avoid accidents remains largely along the lines of safety devices, safety campaigns, etc. And yet how very readily may equally important progress be made in the prevention or elimination of disability by comparatively simple means in avoiding undue physical risks in the personnel accepted for employment. Progress of such nature can be quite as valuable as the most efficient rehabilitation following an injury. And, in any routine of pre-employment physical examinations, it is the roentgenological part which will most frequently afford tangible evidence of value in deciding suitability for employment.

Any illustrative examples I may offer are superfluous to us with our knowledge of the revelations of our work but the more we drive home at every opportunity the lessons of such preliminary surveys the more quickly, I hope, may this survey become an accessory of the employment department of industry. (Dr. Samuel showed slides of several illustrative cases.)

One could continue indefinitely with such illustrative examples but I am hopeful that the time may come when as much may be accomplished in eliminating undesirable employment risks as we have already done by safety campaigns and improved treatment.

Dr. C. S. Gorsline, Battle Creek, Mich. A few things have been brought out this afternoon that I would like to emphasize. In regard to injuries to various parts of the body, I was hoping that some one would bring out this one particular feature that a roentgenologist should always bear in mind and that has helped me very materially in a great many cases: that is, where certain conditions are alleged and even shown in one part of the body it is always a very good point to x-ray the similar area on the opposite side. I have in mind the case of a knee injury which was rather doubtful. The man complained of great disability and traumatic arthritis. The case was awarded in the first instance. Later I happened to come into the case. I sized the man up, and I x-rayed the opposite knee. I found he had a more extensive proliferative arthritis in the right knee than he did in the left knee of which he complained. In fact, it was only a short time later when the adjuster from the insurance company went into the country to locate him that he was working on soft ground. He was not favoring his limb at all, but as soon as he saw the adjuster coming across the ploughed field, he started to limp.

In regard to the matter of traumatic tumor, I believe that the Board in Michigan has improved in the character of their decisions and in their impartiality. However, I have one distinct case in mind where some three years before the second claim was put in I amputated three fingers, I think one completely and two partially, for a machine injury. About three years after his injury a tumor appeared about the mid-third of the humerus of the same arm. I believe that was determined to be a sarcoma. A resection of the humerus was done, I think at the University Hospital. About a year later he asked to have his case reopened because he had lost the use of his hand. His compensation had been specific on the loss of his fingers. The case was brought to the Board, and he was allowed loss of the use of the hand, whereas his loss was based upon the resection of the humerus and the hand showed no further change up to the time the tumor appeared. After getting that entering wedge I understand that the case is now to be reopened again with a view to getting compensation for the loss of an arm, and if that was a sarcoma a death claim is in the offing. I do not see where there is any connection after three years between a sarcoma of the humerus and the amputation of three fingers.

I do not agree with Mr. Rhoads in regard to medical representation upon the Industrial Board of this state. I have talked with Mr. Rhoads personally in regard to the matter, and I think the case that I have just cited is one evidence at least why we should have competent medical representation upon the Industrial Accident Board, so that a better interpretation may be made of the evidence that comes in. It is twenty years this month since the compensation law went into effect in Michigan. I have had more or less familiarity with it since, and one has only to listen to some of the questions that some of the deputies ask to know that what is being sought after is being missed entirely. I think, that the law in Michigan is now administered better than ever, but I think certain improvements should be made.

* Papers of Drs. Gillies, Sante, Hartman, Doub, Key, Kessler, Foster, and Rhoads.

In Dr. Key's article I am impressed with one point that he made, especially in regard to traumatic neurosis, that being the extreme case. That is, that the measure of the success you have in getting your people back to work is measured by the cooperation of the employer. One firm that I have been privileged to serve for a number of years has not for years had a hearing brought up before the Commission with regard to getting a man back to work. It is simply because they have listened to what I have tried to advise them, and have cooperated in giving the man suitable work and encouragement.

Dr. H. J. Walton, Baltimore, Md. Just a word in regard to Dr. Key's remarks about disuse atrophy. I feel that this decalcification is largely a pressure atrophy. It takes but little pressure upon normal bone to produce roentgenographic changes in its structure. This is easily demonstrated in cortical brain tumors, or where there is increased intracranial tension, either general or local.

In the treatment of fractures, the question has frequently been asked why marked decalcification occurs in one instance, and in another the bones show practically no change. I think this can easily be explained by the amount of swelling that occurs in the soft tissues from the tightness with which the splints and bandages are applied. We have all noticed the extreme decalcification that frequently occurs, especially in bones of the lower extremities where there is marked edema, and this increased porosity will continue as long as swelling lasts.

Dr. Key (*closing*). In answer to the question on pressure atrophy. I did not mention that because I believe that pressure may cause local resorption of bone and I differentiate between local atrophy and local resorption. In this paper I limited my remarks to bone atrophy. In previous publications I have shown that local pressure may cause either resorption or new formation of bone and that at present we are not in a position to explain why in one instance the bone is resorbed while in another instance it hypertrophies as a result of pressure.

Dr. Kessler (*closing*). The subjects that were under consideration today before your Society have been my daily problem for the last twelve years. They have been considered from the clinical, pathological and experimental side. The question of the relation between injury and disease might also be approached from a statistical point of view. I personally have had occasion to examine more than 75,000 cases of injury, and in that large number I have failed to find that relation between injury and disease which some authors have claimed. For example, in this entire series I have not had more than 35 cases claim compensation for malignancy, and of those cases only 19 were compensated. This is a small number to result from trauma. A very small number of cases without any reasonable degree of doubt show a relation between injury and disease. As a matter of fact, the number of claims for traumatic tuberculosis was less than the normal incidence of tuberculosis in the entire population. The question of the relation between injury and disease and the determination of the temporary and permanent disability period is becoming more and more the problem of the average physician as well as of the expert. The very fact that these questions are brought before an organization such as this shows great progress

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NON-OPAQUE FOREIGN BODIES IN THE BRONCHIAL TREE

REPORT OF THREE CASES

By ROBERT C. PENDERGRASS, M.D.
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THE detection of opaque foreign bodies in the tracheobronchial tree by roentgenologic examination offers no difficulty, but non-opaque foreign bodies in this location often present serious diagnostic problems.

The history of aspirating a foreign body is not always obtainable, for obvious reasons. A coughing or choking attack may cause the parents to suspect that something has been aspirated, but if the attack subsides readily, the incident is soon forgotten, and in many cases no medical aid is sought. More anxious parents may carry the child to a physician who makes a roentgen examination of the chest, sees no foreign body, and dismisses the case. Later, that child may be returned with a history of fever, cough, or "chest cold," and be found to present definite physical signs of lung pathology. From the history and physical findings, a diagnosis of bronchitis, tuberculosis, or bronchopneumonia may be made. A second roentgen examination may reveal evidence of bronchial obstruction with the accompanying lung changes. It is important that such changes be recognized in order that bronchoscopy may be done.

In other instances, the results of bronchial obstruction by a non-opaque foreign body may be so acute in their onset and symptoms that a diagnosis of pneumonia is made and the patient treated accordingly. This is especially apt to occur if the history contains no suspicion of aspiration of a foreign body. A leucocytosis may be present, adding still further credence to the theory of a simple pneumonia. Even the roentgen findings may be somewhat confusing, particularly if only one lobe is involved. The increased density of the lung in the roentgenogram, the dyspnea, the cyanosis, rapid pulse, leucocytosis, impaired resonance and abnormal breath sounds, all unite in shaping a diagnosis of pneumonia unless the possibility of foreign body atelectasis is borne in mind and its peculiar roentgenologic characteristics recognized.

In still another variety of case, the symptoms are cough with moderate fever. Physical examination of the chest fails to reveal any marked changes. Roentgen examination shows no opaque foreign body, and there is no pulmonary consolidation or atelectasis. In this type of case, the non-opaque foreign body produces incomplete bronchial obstruction, and a ball valve mechanism is set up in the partly obstructed bronchus, with fairly good ingress of air on inspiration, and poor egress on expiration. The roentgenological appearance is that of slight pulmonary congestion in the former instance, and emphysema in the latter. Manges is credited with the establishment of this valuable roentgenological sign.[1] It applies to intrabronchial tumors as well as to foreign bodies.

ROENTGENOLOGICAL SIGNS

The chief roentgenological signs following aspiration of a foreign body and its lodgment in a bronchus are of the three types mentioned above; (1) massive atelectasis, with retraction of the heart to the diseased side; (2) incomplete atelectasis, with a mottled shadow suggestive of bronchopneumonia, but usually on only one side, and (3) incomplete obstruction of the bronchus with demonstrable ball-valve action.

The characteristic picture of lung abscess may be found, as the presence of a foreign body, particularly of the vegetable type, favors development of pulmonary infection with subsequent abscess formation.

In those cases where the history is such as to lead the clinician to suspect unresolved pneumonia, the roentgen diagnosis may be extremely difficult, and unless the typical signs of atelectasis are present may be impossible.

Those unacquainted with the physical signs of atelectasis may suspect empyema. In differentiation, the chest wall is contracted in atelectasis, bulging in massive empyema; the heart is displaced to the diseased side in atelectasis, away from the diseased side in empyema; breath sounds are often diminished but seldom absent in atelectasis, they are more often absent in empyema. The contraction of the chest wall, the cardiac retraction, and the raised diaphragm in atelectasis should prove helpful roentgenological signs.

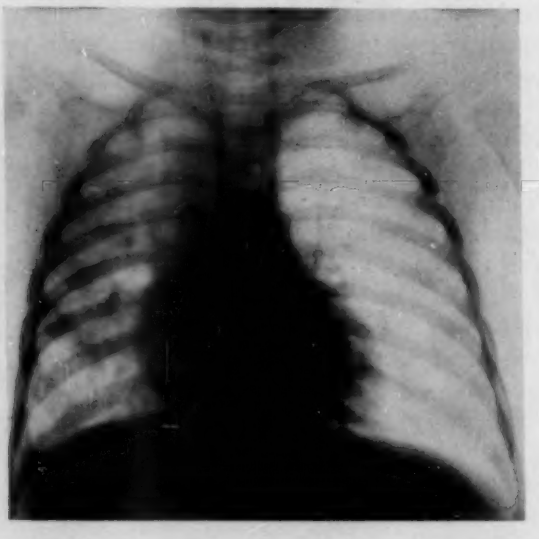

Fig. 1*a*. Case 1. February 21, 1931. Note congestion of right lung, retraction of heart to right, emphysema of left lung.

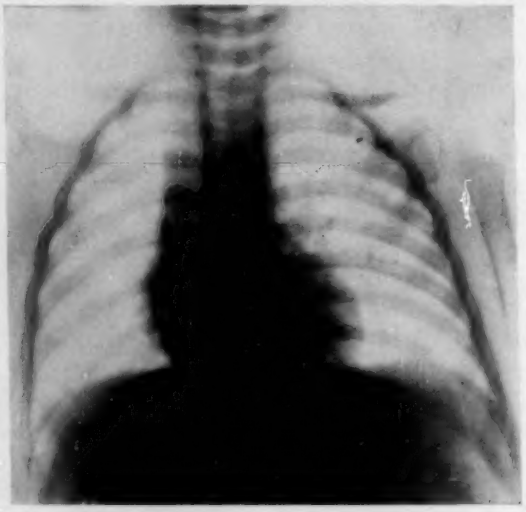

Fig. 1*b*. Case 1. March 2, 1931. Chest normal except for slight retraction of heart and trachea to right. Ten days after expulsion of mucous plug.

CASE REPORTS

The three following cases are presented because they illustrate the clinical and roentgenological findings commonly encountered after aspiration of a non-opaque foreign body.

Case 1. White male, aged twenty months, referred by Dr. J. B. Collum, February 21, 1931.

This child had had a cold for three weeks, but a physician was not called until a "choking spell" occurred on the morning of February 21. Examination showed the nasal passages and throat clear, temperature normal, respiration rapid, finger nails and feet blue, and the child almost lifeless. By 11 A.M. respiration was more labored and rapid, temperature 102.5°F., and the left chest wall bulging, with the right somewhat flattened. The referring physician made a diagnosis of blockage of the right bronchus, probably by a foreign body.

At 12:30 P.M., at the time of the roentgen examination, the respiration was 40 per minute; there were dullness and increased pitch of breath sounds over the right upper chest posteriorly, and there were numerous râles throughout the right base and the left lung. The left chest was more resonant than the right. Cyanosis was marked. Roentgen examination showed moderate displacement of the heart to the right, elevation of the right diaphragm, and a mottled infiltration of the right lung. The left chest was emphysematous (see Fig. 1*a*). A tentative diagnosis of pneumonia was made, but bronchoscopy was advised if the child's condition improved sufficiently to permit the procedure being undertaken.

About three hours after the roentgen examination, the child coughed up a firm white mass "about the size of the end of the thumb." The

mother then pulled a mucous plug from the child's throat. Relief of the dyspnea was almost instantaneous, but the child was exhausted. The temperature subsided during the night. There were rhinitis and cough for several days but the rapid respiration, cyanosis and evident distress disappeared promptly after expulsion of the mucous plug. The parents did not determine what constituted the core of this plug, but they recalled that the child had eaten peanuts several days previously. Roentgen examination ten days later disclosed a normal chest (Fig. 1*b*).

Comment. This case represents a failure to make a correct roentgen diagnosis of bronchial obstruction by a non-opaque foreign body. In retrospect, the following points should have led to such a diagnosis: (1) the sudden choking attack; (2) the marked retraction of the heart to the side of the diseased lung. This does not occur in pneumonia to the extent noted in obstructive atelectasis; (3) the definite emphysema of the left chest, compensatory to the right atelectasis, and (4) the sudden onset of the dyspnea in a patient already ill for some time.

Case II. White male, aged two and a half. Referred by Drs. Foster and Lunceford, Preston, Ga., December 8, 1930.

Fig. 2*a*. Case II. Ball valve action of foreign body in left bronchus. December 8, 1930. Inspiration. Diminished aeration of left lung, heart retracted to left, left intercostal spaces narrowed, left diaphragm raised.

One week previously the child was eating peanuts and had a "bad choking spell." Following this, there was a rather worrisome cough with slight elevation of temperature. A few

Fig. 2*b*. Case II. Expiration. Normal expiratory congestion of right lung, emphysema of left lung, heart returned to more normal position.

râles were heard in the left chest and breathing was harsh.

Roentgen examination. Pendulum movements of the mediastinum were noted roentgenoscopically. The inspiratory film showed retraction of the heart to the left, diminished aeration of the left lung, and contraction of the left intercostal spaces. The expiratory film showed displacement of the heart to the right, congestion of the right lung, emphysema of the left lung, and relative divergence of the left intercostal spaces. These findings were consistent with the "Manges sign" for ball valve obstructions of the bronchus. A diagnosis of non-opaque foreign body in the left bronchus was made, and bronchoscopy advised. On the following day, Dr. I. W. Irvin removed a peanut from the left stem bronchus. Recovery was uneventful (see Figs. 2*a* and 2*b*).

Comment. The valve action of a bronchial foreign body is well illustrated in this case. The dilated bronchus admitted air to the left lung on inspiration; the bronchus contracted around the peanut and trapped air in the left lung on expiration. It is often difficult, in small children, to obtain films at the desired stages of respiration, but

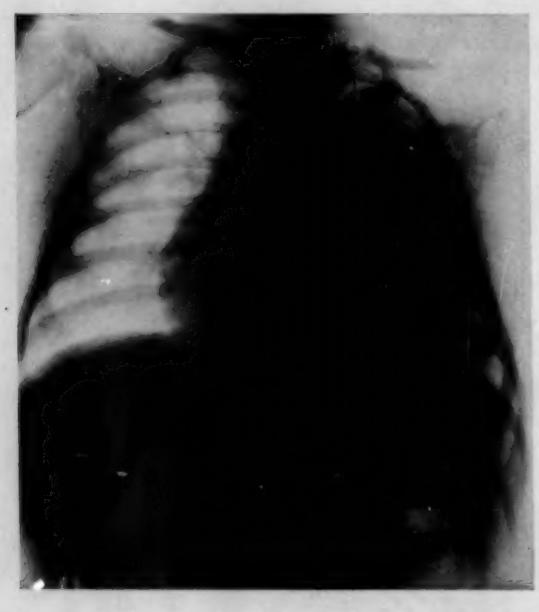

Fig. 3*a*. Case III. February 14, 1932. Obstructive atelectasis of left lung. Note contraction of left chest wall and partial aeration of apex and costophrenic angle.

the use of rapid technique and patience will usually yield satisfactory results.

Case III. White female, aged one year, referred by Dr. W. E. Thomasson on February 14, 1932.

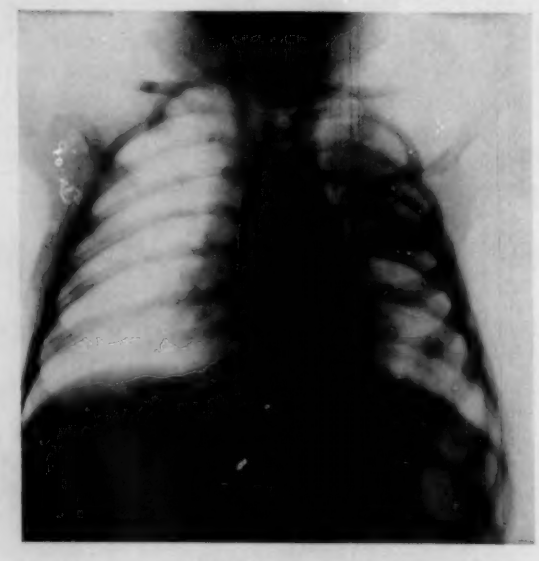

Fig. 3*b*. Case III. February 17, 1932, twenty-four hours after removal of paper from left bronchus. Note increased aeration of left lung.

For the past six weeks, the patient had had a cough and cold. The physical findings at no time definitely indicated pneumonia although there were dullness, decreased breath sounds, and increased voice pitch over the entire left lung. The left chest wall was flattened. These signs did not appreciably change during the five weeks the child was under observation. Temperature ranged from normal in the morning to 102°F. in the afternoon. Roentgen examination was repeatedly advised but refused by the parents until February 14, 1932, in the sixth week of illness. At this time the physical findings were as stated above, and it was noted that the child did not appear acutely ill.

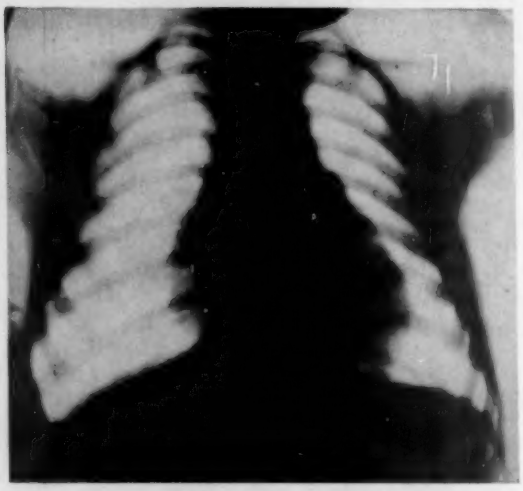

Fig. 3*c*. Case III. July 16, 1932, five months after removal of obstruction. Normal chest.

Roentgen examination showed almost complete atelectasis of the left lung, slight displacement of the heart to the left, elevation of the left diaphragm, and narrowing of the intercostal spaces. The roentgen diagnosis was stenosis of the left main bronchus, probably by a non-opaque foreign body, with resultant atelectasis of the left lung. This diagnosis was made despite the fact that no history of aspiration of a foreign body could be obtained even after careful questioning.

On February 16, 1932, Dr. I. W. Irvin removed at bronchoscopy a small piece of blue paper from the left bronchus. Roentgen examination on the following day revealed marked increase in the aeration of the left lung, and return of the heart to a more normal position (see Figs. 3*a* and 3*b*).

Roentgen examinations were again made on February 23 and March 5. There was still some atelectasis of the left upper lobe. Examination on July 16, 1932, revealed a normal chest (Fig. 3*c*).

Comment. The clinical findings and history in this case would lead one to suspect unresolved pneumonia, lung abscess or tuberculosis. The roentgen examination revealed an atelectasis, but bronchoscopy was necessary to determine the exact cause of the bronchial obstruction.

DISCUSSION

Among the conditions with which bronchial obstruction due to non-opaque foreign bodies may be clinically confused are: pneumonia, acute or unresolved; lung abscess; asthmatic obstructive atelectasis,[2] massive tuberculosis; atelectasis due to extrinsic pressure by enlarged tracheobronchial glands or tumors; intrabronchial tumors, benign or malignant; congenital bronchial stricture,[2] and laryngeal diphtheria. A roentgen study of suspected cases is always indicated, and often proves diagnostic, although even this diagnosis needs bronchoscopic confirmation. No case should be submitted to bronchoscopy without roentgenological examination, and the combination of the two procedures offers excellent opportunity for medical teamwork.

The roentgenological examination should consist of roentgenoscopy and of films made in inspiration and expiration. Lateral views of the thorax are of value in determining what lobes are involved.

Bronchography with iodized oil would demonstrate bronchial obstruction but its application in children, in whom the majority of the cases of foreign body aspiration occur, is often difficult. If this procedure is employed in a child in a suspected case of bronchial occlusion by a foreign body, the transcricoid route should be used, as attempts to introduce oil between the vocal cords by means of a catheter might so traumatize the cords as to produce edema, a condition unfavorable to the eventual bronchoscopy which must be done to remove the foreign body.

The possible presence of a foreign body in the tracheobronchial tree should always be borne in mind in considering pulmonary disease in children.

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AN UNUSUAL ROENTGENOLOGIC FINDING IN MULTIPLE MYELOMA*

By EDWIN L. RYPINS, M.D.
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THE bone marrow is a highly important source of destructive tumors, and it is "probable that specific diseases result from the overgrowth of each particular cell composing this tissue" (Ewing[2]).

FIG. 1. Photograph showing subcutaneous nodules.

Thus, broadly speaking, any primary tumor of bone, which contains the blood-forming cells can be classified as multiple myeloma. This viewpoint may help clarify the present conception that multiple myeloma is a definite clinical entity.

We believe that the following case is of interest, both from a clinical and a roentgenologic standpoint:

CASE REPORT

H.S., white female, married, aged twenty-two, was admitted to the medical service of the University Hospital on the service of Dr. C. W. Baldridge on December 5, 1930. Patient was five months pregnant, and well, up to May 31, 1930, at which time she began to develop a steady pressure-like pain in the sacrum. A premature delivery in June, 1930, was done in an effort to give patient relief from the pain. Relief was obtained, although the fetus died. For two weeks post partum she had an unexplained fever. She also noticed that she bled more easily and lost more blood at this delivery than at previous deliveries. In July, 1930, patient had "rheumatism" involving ankles, knees, elbows, and wrists. She had no fever at this time, nor did the affected joints become red or swollen, In September, 1930, patient first noticed some small, papular, very hard skin lesions on her face and neck. These skin lesions have gradually spread over her body. She has noticed some slightly enlarged glands in her neck for an indefinite period. She thought she had lost weight.

Family and past history not essential. She has one child living and well. Examination at entrance revealed whitish, hard, shotty papules about 5 mm. in diameter, apparently subcutaneous and generalized, except over upper trunk and back. These felt like the lesions of smallpox, and were not tender. The elbow, wrist, and finger joints were swollen, stiff, and tender. These joints were tender on motion but were not hot or reddened. A peculiar feature was that patient stated that the skin nodules would come and go. Cervical, axillary, and inguinal glands were palpable. The left lobe of the liver was three finger breadths below the costal border.

Laboratory Data. Hemoglobin varied from 33 to 39 per cent; red blood cells from 2,000,000 to 2,375,000; and white blood cells from 6,800 to 11,600. The typical differential count was—myelocytes, 22 per cent; basket cells, 21 per cent; lymphocytes, 14 per cent; unclassified cells, 13 per cent; band polymorphonuclears, 6 per cent; metamyelocytes, 7 per cent; basophilic myelocytes, 1 per cent, Turck's irritation cells, 1 per cent; eosinophiles, 3 per cent; basophiles, 1 per cent. Nucleated red cells with variation in size and shape of the red cells were found. Blood Wassermann negative. Coagulation time was five minutes, with bleeding time fifteen minutes. Arm band test for petechiae strongly positive. There were 10 per cent reticulocytes. Blood calcium was 11 mg. and blood phosphorus 4.0 mg. Blood cholesterol was

* From the Department of Roentgenology, State University of Iowa, Iowa City, Iowa.

192.3. Basal metabolic rate varied from +64 to +70. Urine negative for Bence-Jones protein. A biopsy of a lymph gland from one groin and a section of skin were reported as metastatic carcinoma.

She was given roentgen therapy to a small area about 8×10 cm. over the anterior right thigh with the following factors: 4 ma.; 140 kv.; 50 cm. distance; 3 mm. Al as filter, and 200 r as a dose, once. The subcutaneous nodules were gone in forty-eight hours from the treated areas.

Fig. 2. Roentgenogram of right hand.

The posterior aspect of the left elbow joint was next treated with the same technique and the same result. We were convinced, following these results, that we were dealing with a very cellular growth, probably primary in the bone marrow.

The course of the patient was progressively worse, and she died about December 30, 1931, at home. A post mortem was performed and the organs sent to University Hospital.

DISCUSSION

The roentgenological findings were extremely interesting. Not only were there

Fig. 3. Lateral roentgenogram of right femur. The "whiskers" and areas of destruction are readily seen.

multiple areas of destruction but there were also attempts at new bone formation, as could be seen by the "whiskers" of bone which were laid down perpendicular to the bones. Similar perpendicular striations

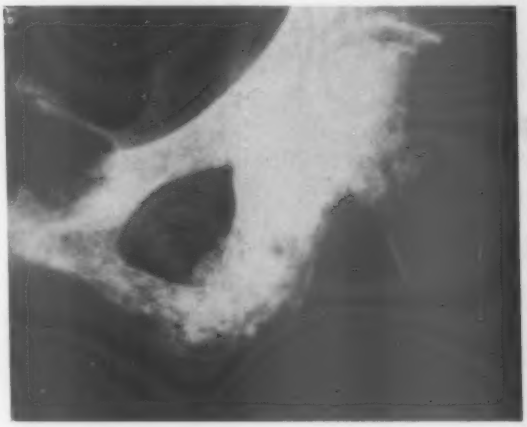

Fig. 4. Anteroposterior roentgenogram of left hip—a contact reproduction.

of bone are seen in osteogenic sarcoma (Ewing). Vogt and Diamond[7] report a similar condition in sickle cell anemia, and state, "The cortex becomes thin and there is occasionally an area that appears to be punched out, due to localized invasion by marrow substance." However, blood examination readily ruled out sickle cell anemia, and also no cases of sickle anemia have been reported in adults. Meyerding[6] suggests the possibility of multiple myeloma causing such reaction as he states, "Later they perforate into the periosseous structures, giving a punched-out appearance, or a honeycomb appearance to the bone, due to the shadow cast from remaining particles of bone on the surface of the tumor." Also, Morse[5] adds "that the myeloma cell may be a heteroplastic 'osteoblast'."

The absence of Bence-Jones protein does not rule out multiple myeloma (Ewing,[2] Geschickter and Copeland[3]), nor does its presence absolutely confirm it (Boggs and Guthrie,[1] Hansen,[4] Geschickter and Copeland,[3] Wood and Lucke[8]).

We have seen similar attempts at healing in both luetic and ordinary osteomyelitis, when only one bone was involved. The generalized involvement made us diagnose the condition as probably a primary medullary bone malignancy.

The pathologic diagnosis was myeloblastoma, the predominating cell being the myelocyte.

SUMMARY

The term multiple myelōma includes any primary bone tumor which contains the blood-forming cells.

A case is here reported, which shows a generalized attempt at healing of a primary bone tumor, ordinarily mentioned as multiple myeloma.

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CARCINOMA OF THE LIP*

REPORT OF RESULTS OF TREATMENT AT THE COLLIS P. HUNTINGTON MEMORIAL HOSPITAL FROM 1918–1926

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OVER 12,000 cases of cancer have been seen at the Huntington Memorial Hospital in the last twelve years and records containing a great deal of data are available for study on each case. With such an enormous number of cases the study of different groups by ordinary methods has become difficult. For this reason we have used a mechanical card system such as is used in the Department of Vital Statistics of the Harvard School of Public Health in an effort to lighten the physical labor of the present study of all cases of disease in or about the mouth.

To use such a system it is necessary to devise a form in which each item of importance in a case history can be answered by yes or no, or by a numerical notation. The items are then recorded on the form directly from the record. For instance, in our work we have recorded the data having to do with the pathological examination of the tumor as follows:

TABLE I

CODE FOR RECORDING PATHOLOGICAL DATA

No. 0—No pathological examination made
1—Epidermoid carcinoma—Grade 1
2—Epidermoid carcinoma—Grade 2
3—Epidermoid carcinoma—Grade 3
4—Epidermoid carcinoma—Not graded
5—Other carcinoma
6—Carcinoma (unspecified)
7—Pre-malignant
8—Done but negative

Each item on the form shown corresponds to a given space in a given row on the small cardboard card to which the data are transferred by punching a hole in the card at the proper point (Fig. 1). When such cards have been prepared they may be sorted for any item or items desired by placing them in a mechanical sorting machine which runs them through at the rate of 300 cards per minute. As there are 540 spaces on a card it is possible to put a fairly complete summary of a case history on each card. However, the work necessary in designing the forms and getting the data correctly transferred is such that it would not be an efficient method of study in any group smaller than 500 cases.

All diagnosis cards in the hospital files with any diagnosis of carcinoma or other disease of the lips, tongue, jaws, cheek, palate, floor of mouth, and tonsils were listed. Also all cases of carcinoma of the neck. These latter because of possible errors in classification, of which there were a few. The case records were then looked over and all cases arising in the skin or in areas outside the mouth were excluded. In doing this a pathological report of basal cell carcinoma was considered to prove that a case was a skin case if the location did not prove it. All case histories of the group being studied were then recorded on cards, separate forms being used for malignancy, pre-malignant conditions, and non-malignant conditions.

The cases in which the follow-up data were incomplete were then followed very intensively. Letters were written to the patients first, then to any relative named in the record, then to the doctor referring the patient, then to the town clerk if we suspected the patient to be dead. Failing in these attempts, Massachusetts cases were hunted for in the death records at the State House, and failing this the telephone was used (with great success). After all these methods had failed, it was found that a visit to the patient's address would get

* From the Cancer Commission of Harvard University. This work was aided by an anonymous gift to the Harvard Medical School. Read in a Symposium on Cancer of the Lip, Seventeenth Annual Meeting, American Radium Society, New Orleans, La., May 9–10, 1932.

results in 50 per cent of the remainder. The net result is that we can state the present condition or the date and the stated cause of death in over 95 per cent of all cases seen in the clinic. This follow-up was done just as carefully in cases that we did not treat as in cases that we did.

The pathological slides in the Huntington Hospital files were reviewed by Dr. Shields Warren and checked and graded and we have much to thank him for in the painstaking way he helped us in this item. Of the surgical cases none was considered satisfactory that had no pathological report. On the other hand, there were so few data on the pathology of the cases treated with radiation that all were included without regard to pathology.

Inasmuch as many of the patients were given their surgical treatment at the Massachusetts General Hospital, all necessary data on these cases were looked up and incorporated in our records. Where they were of importance, abstracts were also secured from other hospitals.

The data on the patients were recorded uniformly whether the patients were treated at the Massachusetts General or the Huntington Memorial Hospital, although there is a notation on the cards so that they can be distinguished. The few cases which were seen only in the Massachusetts General Hospital during these years were not studied.

An explanation is due in the cases that had more than one carcinoma in the mouth during the period of this study. Metastases are not referred to but new carcinomas, or what we usually call "re-occurrences." It was impossible to record these cases efficiently on the original card, therefore a separate card was made for each separate carcinoma, and we have, therefore, more cards than patients. There are in the series 444 cards on 437 patients with carcinoma of the lip, divided according to location as shown in Table II.

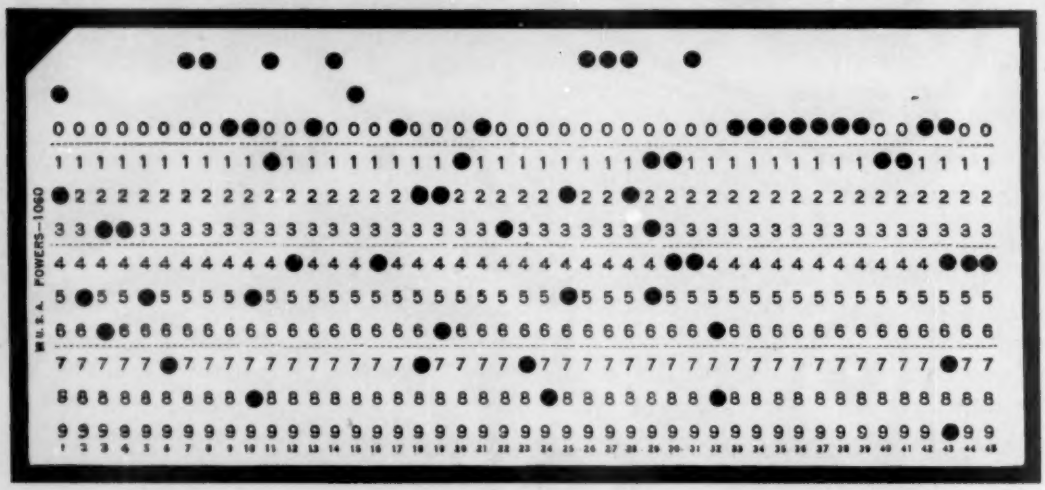

FIG. 1.

TABLE II

LOCATION OF PRIMARY LESION

Lower lip	402
Upper lip	29
Corner of mouth	13
Total	444

The statistics of age, sex, etc., show nothing unusual or new as far as our studies have progressed and will not be mentioned further in this paper.

In presenting the results of treatment we will confine ourselves to a single criterion of success, that is: Did the patient live five years following the treatment with-

out further sign of the disease or did he not? For this reason all results will be divided into three groups:

1. *Successful*—Patients that lived for five years following their last treatment without sign of continuing or recurrent disease. If a case was cured by a second treatment after the first treatment or course of treatments failed, it is counted as a failure of the first and as a success in the group of cases showing the results of our own secondary treatments.

TABLE III

RESULTS OF FOLLOW-UP STUDY

1. Conclusive cases		364
2. Inconclusive cases:		
A. Follow-up incomplete	25	
B. Died without cancer under 5 years	53	
C. No pathological report	2	80
Total		444

2. *Failures*—All cases that had continuing or recurrent cancer within the five-year period whether they died from it or not.

3. *Inconclusive*—All cases that in less than five years had died without continuing or recurrent cancer and all cases which we treated that were lost in less than five years provided they had no cancer when last seen. There were a few untreated cases, never heard from after the first visit, which were excluded.

A certain number of cases had been treated before entry and came in without evidence of disease for consultation or for prophylactic treatment. If they later developed recurrence or metastases and were treated, they were coded as recurrent cases. But there were 12 such cases that never developed cancer and have been put in a special class by themselves under the name of prophylactics.

Table IV will show the number of cases divided according to the groups just mentioned and into primary or secondary cases. All patients who had no treatment or treatment with washes, ointments, pastes, roentgen rays and radium were classed as primary. Those on whom any operation greater than a biopsy had been done were classified as secondary.

TABLE IV

STATUS OF CASES ON ENTRY AND THEIR DISPOSITION

Conclusive Cases Only

1. Primary		
A. Treated at Huntington Memorial or Massachusetts General Hospital	181	
B. Not treated at Huntington Memorial or Massachusetts General Hospital	56	237
2. Secondary		
A. Treated at Huntington Memorial or Masssachusetts General Hospital	88	
B. Not treated at Huntington Memorial or Massachusetts General Hospital	27	
C. Prophylactics	12	127
Total		364

Before studying final end-results of any groups in detail, it is important to point out the dangers of any treatment given. There was no morbidity or mortality that could be attributed solely to radiation treatment, but there were two deaths from surgical treatment as shown in Table v.

Table v includes all the operations on all the 444 cases of carcinoma of the lip, whether the cases were suitable for later end-result study or not. Operative mor-

TABLE V

OPERATIVE MORTALITY

	Operations	Deaths	Mortality Per cent	Cases	Deaths	Mortality Per cent
Local operation only (Includes plastics)	97	0	0	84	0	0
Lip and neck	97	1	1.03	93	1	1.07
Neck alone	18	1	5.54	11	1	9.10
Total major operations	115	2	1.74	104	2	1.92

tality refers to death in the hospital at any time during the period of admission in which the operation was done. It happens that both deaths occurred on the operating table—in each case probably from anesthesia.

The first group of cases to discuss is the group of primary cases which we treated ourselves. Table VI will show the condition of the glands as found on examination at the time of admission to the hospital.

Table VII will show results of treatment of the primary cases without glands. The table is divided to show our results in the first five and in the last four years of the period studied. In no instance were combined treatments given except that some of the surgical patients had postoperative roentgen treatment. There was no significant difference in the results in the patients with and without it.

It is easy to see that a considerable improvement in results of treatment is shown in comparing the two periods. This is partly due to the greater percentage of patients coming in with smaller and therefore more favorable lesions. But even in cases of the same size there was an improvement in results except in the case of large tumors. It will be noted that there was a tendency to do less radical operations and to treat a larger proportion of the patients surgically in the later period. There is no doubt that, of the large tumors treated by radiation, many were perfectly hopeless, and that this group cannot be compared directly against the group of large tumors treated surgically.

TABLE VI

PRIMARY CASES. EXAMINATION OF GLANDS OF NECK

1. With enlarged glands	34
2. Without enlarged glands	147
Total	181

NOTE: Item 2 includes all cases in which the glands are described as small, not enlarged, not felt, not mentioned or enlarged up to and including 1 cm. diameter.

TABLE VIII

RECURRENT CASES TREATED AT HUNTINGTON MEMORIAL AND MASSACHUSETTS GENERAL HOSPITAL

1. Glands enlarged 1.1 cm. or more	41
2. Glands less than 1.0 cm.	47
Total	88

TABLE VII

147 PRIMARY CASES WITH SMALL OR NO GLANDS

Size of Lesion	First Treatment	1918–1922 Cases	1918–1922 Per Cent Cured	1923–1926 Cases	1923–1926 Per Cent Cured
0–1.0 cm.	Local operation	11	82	25	92
	Major operation	10	90	7	100
	Irradiation	12	58	7	86
	Total	33	75	39	92
1.1–2.0 cm.	Local operation	3	67	3	67
	Major operation	14	86	12	75
	Irradiation	7	14	3	67
	Total	24	63	18	72
2.1 cm. and over	Local operation	3	33	3	67
	Major operation	6	50	5	40
	Irradiation	9	11	7	14
	Total	18	28	15	33
All sizes	Grand Total	75	60	72	75

NOTE—Local operation = excision of lesion with or without plastic.
Major operation = Dissection of submental and isolateral submaxillary region in addition to excision of tumor.

TABLE IX

47 RECURRENT CASES WITH SMALL OR NO GLANDS

Size of Lesion	First Treatment	1918–1922 Cases	1918–1922 Per Cent Cured	1923–1926 Cases	1923–1926 Per Cent Cured
0–1.0 cm.	Local operation	—	—	2	100
	Major operation	2	50	6	83
	Irradiation	6	0	3	33
	Total	8	13	11	73
1.1–2.0 cm.	Local operation	—	—	2	50
	Major operation	3	33	4	75
	Irradiation	1	0	1	0
	Total	4	25	7	57
2.1 cm. and over	Local operation	1	0	1	0
	Major operation	1	0	—	—
	Irradiation	6	17	3	1
	Total	8	13	9	11
All	Grand Total	20	15	27	48

Table VIII will show the condition of the cervical lymph nodes in our recurrent cases. The proportion of those with definitely enlarged glands is much greater than in the primary cases.

The results of treatment of the cases without enlarged glands comes next and will be shown in a table exactly like that showing the primary cases. Here the improved results of treatment are even more striking than the results shown previously. Again we treated more cases surgically (Table IX).

Now we will turn to the cases with enlarged glands—1.1 cm. in diameter or more. As the glands rather than the primary lesion are the determining factor in the results, the cases will not be divided according to the size of the lesion. Table X shows the primary cases.

Table XI shows the secondary cases.

These tables need very little discussion. Many of the cases were hopeless. The only cures were accomplished by surgical removal of the glands.

The next item for consideration is the results of our own secondary treatments. These include cases that were both primary and secondary on arrival and refer only to our own second attempt. No case was saved by irradiation or further surgery after our own first surgical treatment had failed, but in 3 cases we were able to produce a cure by surgery when irradiation had apparently failed. These were all early cases and in none of them was a dose of radium used

TABLE X

PRIMARY CASES WITH GLANDS OVER 1.1 CM.

Treated at Huntington Memorial and Massachusetts General Hospital

Treatment	1918–1922 Cases	1918–1922 Per Cent Cured	1923–1926 Cases	1923–1926 Per Cent Cured
Local operation	3	0	1	0
Major operation	3	33	3	67
Irradiation	13	0	11	0
Total	19	5	15	13

TABLE XI

RECURRENT CASES WITH GLANDS 1.1 CM.

Treated at Huntington Memorial and Massachusetts General Hospital

Treatment	1918–1922 Cases	1918–1922 Per Cent Cured	1923–1926 Cases	1923–1926 Per Cent Cured
Local operation	1	0	0	—
Major operation	4	25	2	0
Irradiation	16	0	18	0
Total	21	5	20	0

that we would now expect to accomplish results. One of our local operation failures was cured by another surgeon by a second more adequate local operation than was done here.

TABLE XII

PRIMARY CASES WITHOUT GLANDS

Not Treated at Huntington Memorial or Massachusetts General Hospital

Size of Lesion	1918–1922 Cases	1918–1922 Per Cent Cured	1923–1926 Cases	1923–1926 Per Cent Cured
Up to 1 cm.	12	83	12	100
1.1–2.0 cm.	10	70	9	67
Over 2.1 cm.	5	20	4	0
Total	27	67	25	72

Table XII will show some patients who came to see us and on whom we advised treatment, but the treatment was carried out elsewhere than at the Huntington Memorial or Massachusetts General Hospital.

It will be seen that the results are about as good as ours, but they do not show as striking an improvement. Whether the natural selection of these patients is such that an entirely fair comparison of results can be made is very doubtful. Therefore we do not stress Table XII but merely put it in for its own interest.

We will now try to analyze what changes in methods of handling were responsible for the great improvement in results in the cases that were not hopeless. First, it could not be due to more radical operations as many less patients had operations on the glands. Fewer cases were also treated by radiation, but those that were did much better. Was it due to increased dosage of radium or better technique? Table XIII will show some data on radium dosage.

Table XIII surprises us very much, in that such good results were achieved with such small doses. Certainly there was no increase in dose during this period.

If our dosage of radium did not increase and our surgery did not become more radical, there is no other conclusion to make but that our selection of cases for the particular treatment given was more intelligently made.

In 1922 Simmons and Daland[1] published a review of end-results in carcinoma of the lip and showed a marked correlation between pathological grading and prognosis following the idea originally suggested by Broders.[2] Since then we have been greatly interested in grading of certain carcinomas, among them those of the lip. Table XIV shows the results of those surgical cases in the present series from which material was available for grading.

TABLE XIII

RESULTS OF RADIUM TREATMENT IN 42 PRIMARY CASES WITH SMALL GLANDS

Size of Lesion	Dose of Radium	1918–1922 Cases	1918–1922 Per Cent Cured	1923–1926 Cases	1923–1926 Per Cent Cured
0–1.0 cm.	60 mc-hr. or less	5	40	7	87
	61 mc-hr. or more	5	40	0	—
1.1–2.0 cm.	100 mc-hr. or less	4	25	1	100
	100 mc-hr. or more	3	0	1	100
2.1 cm. +	2500 mc-hr. or less	3	0	5	20
	2500 mc-hr. or more	6	17	2	0

In making this table the criterion of failure of treatment is not used, as was done in all previous tables. Local recurrence was considered to be more of an index of inadequate local surgery than of malignancy of the tumor. For this reason the presence of cancer cells in glands removed at operation

[1] Simmons, C. C., and Daland, E. M. The results of operations for cancer of the lip at the Massachusetts General Hospital from 1909 to 1919. *Surg., Gynec. & Obst.*, 1922, *35*, 766–771.

[2] Broders, A. C. Squamous-cell epithelioma of the lip. *J. Am. M. Ass.*, 1920, *74*, 656.

or the later development of gland metastases was used as an index of the metastasizing power of the growth.

Table XIV shows a definite increase in the percentage of metastases in the glands as the tumor shows a less differentiated appearance in the microscope. It would be very easy to go on from here and state that at least a large part of our improved results was due to paying attention to this aspect of our cases. Unfortunately, it is not so simple. The reason it is not so simple is that most of the Grade 1 pathological reports occur on the cases that are among the smallest, and vice versa. Therefore these cases are more favorable for their small size as well as their appearance of slow growth. Table XV differentiates these same cases according to grade and size.

The first thing to note is that almost half the cases occur in one box, that of the lowest grade and smallest size. Another quarter of the cases are in the adjacent boxes of smallest size with medium grade and of smallest grade with medium size. The distribution of the rest of the cases spreads them so thin that the groups are not of great statistical value. However, if one glances down each column, one sees the results in cases of the same size as we progress to cases of higher malignancy. It is perfectly obvious, then, that there is here no statistical proof that higher degrees of malignancy cause higher liability to metastasis in cases of comparable size, as we have just mentioned.

Table XVI shows exactly the same cases divided into the same boxes, but also includes data on the duration of symptoms up to the time of treatment. The duration is expressed in weeks of the median cases of the group. Note that in the Grade 1 cases the duration of those not metastasizing is about half that of those that did so; that similar results occur in Grade 2. But with Grade 3, or the highest degree of malignancy, the duration of the cases not metastasizing was greater than that of those that did, and also was as great as that in the metastasizing Grade 1 cases. Among the large and also among the Grade 3 cases, as well as among those in both classifications, there must be comparatively slowly growing tumors which do not metastasize early.

Hardly a cursory examination of the literature on the grading of cancer of the lip has been made since demonstrating the statistical effect of the relationship of size of tumor to the results of treatment according to grade, but except for a single sentence in Broders' original paper we know of no consideration of this possibility. Broders,

TABLE XIV

PRIMARY, SMALL OR NO GLANDS

All Operations Divided by Pathological Grades, Presence or Development of Gland Metastases

Grade	Cases	Glands Positive Per Cent
1	49	10
2	20	20
3	7	43
Total	76	16

TABLE XV

PRIMARY, SMALL OR NO GLANDS. ALL OPERATIONS DIVIDED BY PATHOLOGICAL GRADES AND SIZE OF TUMORS. PRESENCE OR DEVELOPMENT OF GLAND METASTASIS

Grade	0–1 cm.		1.1–2.0 cm.		2.1 cm.+		Total	
	Cases	Glands+ Per cent	Cases	Glands+ Per cent	Cases	Glands+ Per cent	Cases	Glands+ Per cent
1	32	6	13	15	4	25	49	10
2	9	11	7	14	4	50	20	20
3	1	0	2	50	4	50	7	43
Total	42	7	22	18	12	42	76	16

however, did mention the fact that there were proportionately more large tumors in his Grade 3 group than in his lower grades. He used four grades but put only 1 per cent of his cases in Grade 4, which was his least differentiated group.

Table XVI

PRIMARY—SMALL GLANDS. ALL OPERATIONS DIVIDED BY PATHOLOGICAL GRADE AND SIZE OF TUMOR. DURATION IN WEEKS BEFORE OPERATION—PRESENCE OR DEVELOPMENT OF GLAND METASTASES

		0–1 cm.		1.1–2.0 cm.		2.1 cm.+		Total	
		Cases	Duration Weeks	Cases	Duration Weeks	Cases	Duration Weeks	Cases	Duration Weeks
Grade 1	No metastases	30	20	11	32	3	20	44	20
	Metastases	2	46	2	32	1	78	5	46
Grade 2	No metastases	8	15	6	20	2	103	16	20
	Metastases	1	78	1	46	2	26	4	39
Grade 3	No metastases	1	46	1	20	2	128	4	46
	Metastases	—	—	1	20	2	39	3	32
Total	No metastases	39	20	18	26	7	78	64	25
	Metastases	3	46	4	32	5	32	12	38

It must not be inferred that we claim that grading of a tumor is unimportant or useless. We only point out that the tables that have correlated grading to prognosis have possibly been so striking because of the distribution of a preponderantly large number of small, easily curable tumors in Grade 1, as was certainly true in this group of cases.

SUMMARY AND CONCLUSIONS

As a result of this study, certain definite broad rules for the management of patients with this disease may be laid down.

There is no justification for not considering the pathological grading of a tumor as an important aid in deciding on treatment, but perhaps it should not be stressed as strongly as size and duration.

1. Small lesions, without deep ulceration, infiltration or enlargement of the glands of the neck may be safely treated by local treatment only. These cases should all be of Grade 1 pathology and should be of comparatively short duration.

2. We believe the best local treatment of small lesions to be an adequate surgical excision, but would also approve adequate radiation treatment following a biopsy. By adequate irradiation we mean doses of from 500–1000 mc-hr. of radium with considerable filtration for small lesions, and larger doses in larger lesions.

3. All other patients up to the limits of reasonably safe operability should have submaxillary and submental neck dissections, whether the local lesion is treated with radium or surgery.

4. Although there is nothing in this paper on the subject, we believe that most patients who have had neck dissections should have at least 900 r of high voltage roentgen therapy to each side of the neck, and that this should be repeated if the glands in the neck are positive for carcinoma.

5. Patients with fixed, deep, or large masses in the neck should be treated by radiation for palliation only.

6. Every case must be decided individually and some must be given less than the optimum treatment for reasons of age, other diseases, or poor general condition.*

* For discussion see page 88.

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FIVE-YEAR END-RESULTS OBTAINED BY RADIATION TREATMENT OF CANCER OF THE LIP*

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BUFFALO, NEW YORK

IN THE past, cancer of the lip was a purely surgical disease. Since the advent of roentgen rays and radium continuous effort on the part of the radiologist has gradually raised the question of which form of treatment is the most efficacious, or whether a combination of the two should be used. If the question were asked of this audience, I venture to say opinion would be divided, each feeling that his method of treatment is the best.

The surgeon urges patients to come early when lesions are small and favorable for excision and dissection of the neck glands, well knowing that the results become poor as soon as metastases are shown in the nodes. Cases past this stage have little appeal to him in a curative way. On the other hand, the radiologist will often presume to treat all types of lip cases, generally after they have been the rounds of various medical advisers, and he probably more often gets the majority of advanced lesions, including the inoperable as well as the recurrent cases, often referred by the surgeon. The surgeon, hoping he can circumscribe all the cancer cells with his knife, cuts far and wide leaving what the cosmetic-minded radiologist insists are ugly deformities. The radiologist treats the lesions with roentgen rays and radium which he trusts will kill the cancer cells, subjecting, as the surgeons say, his patient to future metastases. Here, most properly, steps in the combinationist, the surgeon-radiologist. To him comes the more momentous problem, that of the best method of treatment in combating metastatic lymph nodes, the problem which both the radiologist and the surgeon equally dislike, well knowing that the results are unsatisfactory.

When one consults the literature on this subject the same indecision is apparent. Numerous surgical statistics have been published, but as many lack detail one cannot make a fair appraisal of the merits of pure surgical procedure; for example, Bloodgood[1] states that where the lesions are small and there are no demonstrable enlargements of the lymph nodes, 100 per cent are alive and well after five years, and that about 50 per cent of those showing metastases are well after five years. He does not give any figures on large or extensive lesions of the lip. Fischel[3] reports that 88 per cent of those not showing metastatic nodes are alive and well five years but does not state what percentage of those that have metastases in the lymph nodes are well. Shedden,[4] reporting three-year results for the American College of Surgeons, gives 76 and 42 per cent in the first two groups respectively. Brewer[2] in 1923 compiled surgical statistics which included those of Bloodgood, Beckman, Sistrunk, and his own, and gives 66 per cent well five years after local excision; 92 per cent well five years after radical operation, performed where no metastases were demonstrable; and 34 per cent in cases showing definite metastatic involvement of the nodes.

In this study of the surgical literature some very pertinent questions present themselves: (1) the size of the lesion; (2) its location, whether near the corner of the mouth or at the midline; (3) the duration of the lesion prior to admission; (4) the absolutely known fact that not all enlarged nodes are metastatic and that in a considerable number of cases where no nodes are palpable, metastases subsequently develop. These questions in diagnosis are important in evaluating methods of treatment.

* From the State Institute for the Study of Malignant Disease, Buffalo, N. Y. (Burton T. Simpson, M.D., Director). Read in a Symposium on Cancer of the Lip, Seventeenth Annual Meeting, American Radium Society, New Orleans, La., May 9–10, 1932.

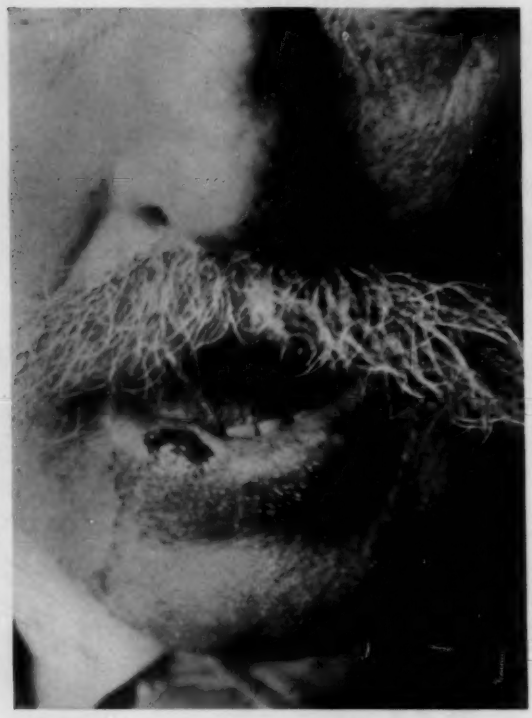

FIG. 1. Small lesion without palpable nodes, before treatment. Group 1 case.

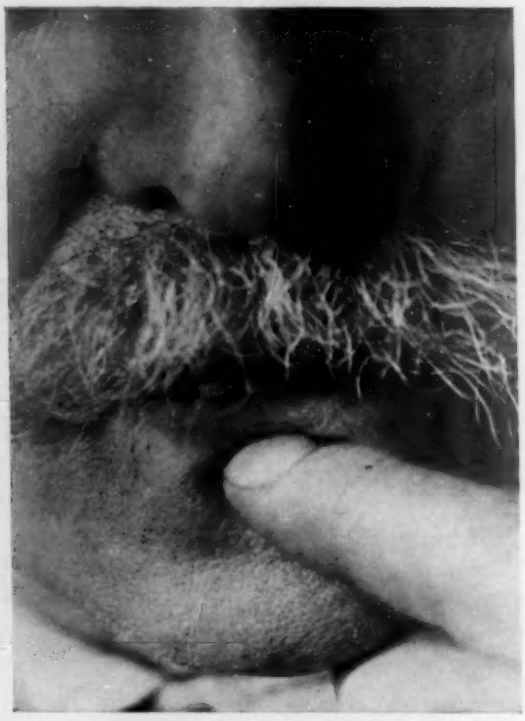

FIG. 2. Same case as Figure 1 after treatment, now well over five years.

The radiologist and surgeon present statistical figures attempting to prove their contention and display enthusiasm for their particular methods, but the truly scientific mind is still in doubt because these figures, when carefully scrutinized, are generally based on too few cases and commonly entail a variety of classifications; that is, based on three- or five-year arrests, on large or small primary lesions, without glands palpable, etc., so that, when all statistics are considered as a whole, very little unity can be derived from them. What is first needed is a satisfactory classification to suit, if possible, the surgeon and the radiologist, so that both may speak a common language. Without this, little can be gained by discussion.

Instead of there being antagonism between the surgeon and radiologist, let all meet on some common ground to establish what is the best procedure for the good of the patient.

With these preliminary facts, we wish to present the results of our analysis of 285 cases treated at the State Institute for the Study of Malignant Disease. All of these cases were treated between 1914 and 1927, during which time the technique of irradiation was undergoing an almost continuous change. Nevertheless in evaluating the results this factor is not stressed and the effort here is to make, if possible, a comparison with the surgical statistics.

It was plain to the workers at the Institute that in order to arrive at any definite conclusions a systematic study with a carefully planned piece of work was necessary. Accordingly, our tumors of the lip were divided into three anatomical groups. In Group 1 were placed all lesions on the lip, no matter how small or how extensive, but with no palpable nodes in the lymphatic drainage areas. Many cases, impossible to deal with surgically except by very wide excision and plastic operation,

fell into this group, making it difficult to compare our results with surgical statistics. In Group II, any size lesion on the lip with definite enlargement of the lymph nodes on one or both sides of the neck which were movable and apparently so-called operable; in Group III, cases recurring after operation with metastases in the neck which were fixed; or untreated cases with extensive involvement of the lip, periosteum of the jaw, or fixed lymphatic involvement.

The technique of the treatment given was as follows: Unfiltered roentgen rays to the local lesion, an estimated value of two to four times the erythema dose, 140,000 peak voltage, 10 milliamperes, no filter, time from 3 to 9 minutes, at a distance of 20 to 22 cm.[5] Radium treatment consisted of large amounts of radium filtered through 0.1 mm. brass, held in position for from 15 to 16 mc-hr.; the application of radium tubes for 200 to 250 mc-hr. per tube, filtered through 2 mm. brass, 1 mm. rubber; or the implantation of glass seeds of 1.0 or 0.8 mc. of radon. High voltage roentgen treatment to the neck, and in a few instances covering the lip tumor, consisted of

TABLE I

RESULTS OF TREATMENT OF 163 GROUP I CASES—NO ENLARGEMENT OF NODES IN NECK

	Treatment to Local Lesion Only—131 Cases		Treatment to Local Lesion and Surrounding Lymph-Bearing Areas—Prophylactically—32 Cases	
	Lesions 1.5 cm. or less; 70 cases 98.5 per cent primary healings	Lesions over 1.5 cm.; 61 cases 91 per cent primary healings	Lesions 1.5 cm. or less; 12 cases 100 per cent primary healings	Lesions over 1.5 cm.; 20 cases 95 per cent primary healings
Five-year healings Relative Absolute	40 cases—85% —57%	21 cases—58% —34%	6 cases—86% —50%	10 cases—59% —50%
Died of cancer Primary healings Recurrence primary lesion	3 cases 2 cases	13 cases 8 cases 4 cases	1 case 1 case	6 cases 5 cases 5 cases
Living over five years, now well, but not continuously well for five years	4 cases	2 cases		1 case
Died from intercurrent disease*	17 cases—all well at time of death	9 cases—all well at time of death	3 cases—2 well at at time of death, 1 had recurrence	1 case—well at at time of death
Lost trace of*	6 cases 3 clinically well 3 undetermined	16 cases 11 clinically well 4 undetermined	2 cases Both clinically well	2 cases Both clinically well
Developed enlarged nodes	9 cases	17 cases	1 case	7 cases
Nodes disappeared under treatment	6 cases	4 cases		1 case

* Cases lost trace of and those who died from intercurrent disease are not considered in estimating the relative five-year healings.

Fig. 3. Large lesion without palpable nodes, before treatment. Group 1 case.

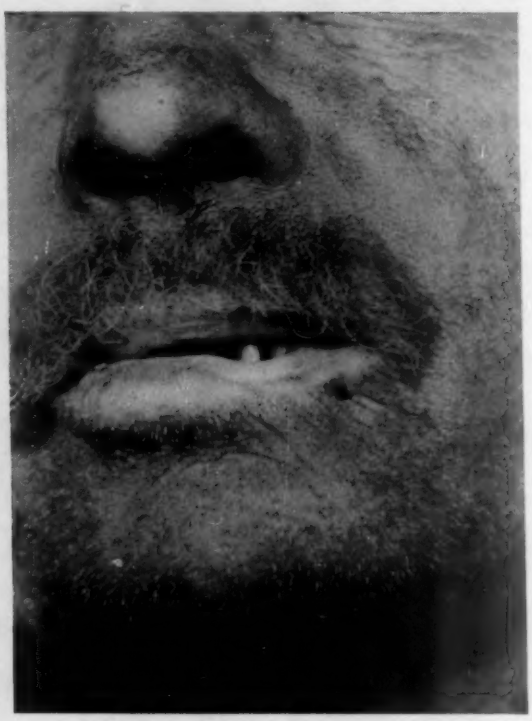

Fig. 4. Same case as Figure 3 after treatment, now well over five years.

200,000 volts, 8 milliamperes, filter 0.5 mm. copper and 1 mm. aluminum, distance 30 to 50 cm., time varying as to the distance used. Factors for the filtered low power roentgen radiation were: 140,000 peak voltage, 5 milliamperes, 3 mm. aluminum filter, time from 8 to 10 minutes, at a distance of 25 cm.

One hundred and sixty-three cases were placed in Group 1 (see Table 1).

One hundred and thirty-one cases were treated locally only with unfiltered roentgen rays or radium. Seventy of these were small lesions of 1.5 cm. or less; 61 were large lesions measuring over 1.5 cm.

Of the 70 small lesions, 40 have been well five years or more after treatment. This group shows 85 per cent relative five-year healings and 57 per cent absolute five-year healings. Three died from metastases; in 2 the lip had been well, one for four years and one for one year; in the other case the lip never healed. Four are living over five years, are now well, but have not been continuously well for five years. Seventeen died from intercurrent disease; all were free from any evidence of malignancy; 4 for over four years, 5 for over three years, 3 for over two years, 2 for over a year, and 3 for less than a year. Six were lost trace of, 3 were clinically well for from less than a year to over two years, 3 did not return after treatment so the result was undetermined. Nine in this group developed enlarged nodes which we thought might be metastatic, in only 3 cases did the nodes progress causing death, in the other cases they disappeared following treatment. Primary healing was achieved in 98.5 per cent of these cases.

Of the 61 large lesions, 21 have been clinically well five years or over. This group shows 58 per cent relative five-year healings and 34 per cent absolute five-year healings. Thirteen died from metastases, in 4 the lip was well at the time of death, in 4

the lip healed after treatment but recurred, in 5 the lip never healed. Two are living over five years, are now well, but have not been continuously well for five years. Nine died from intercurrent disease, all were well at the time of death, 2 for over three years, 3 for over a year, 4 for less than a year. Sixteen were lost trace of, in 11 the lesion was well, 1 for four years, 3 for over three years, 3 for over two years, 2 for over one year, 2 for less than a year; 4 were undetermined as they did not return after the first treatment; in one case the primary lesion was healed but the metastases which had developed were progressing. Seventeen in this group developed enlarged nodes which we thought might be metastatic; in 13 cases the nodes progressed causing death, the other 4 disappeared with treatment. Primary healing was achieved in 56 cases, or 91 per cent.

Thirty-two cases were treated over the surrounding lymph-bearing areas as well as locally. Twelve of these were small lesions of 1.5 cm. or less; 20 were large lesions measuring over 1.5 cm.

Fig. 5. Large lesion on lip with palpable nodes in left submental and submaxillary regions, before treatment. Group II case.

Fig. 6. Same case as Figure 5, after treatment, now well over five years.

Of the 12 small lesions, 6 have been clinically well five years or over; 86 per cent relative five-year healings, 50 per cent absolute five-year healings. One died from metastases five years after admission, the lip remained well from the time of first treatment. Three died from intercurrent disease, 2 had been well for over three years, one was clinically well for one year when he had a recurrence and shot himself. Two were lost trace of in less than a year, both lesions were well. Only one in this group developed metastases; 100 per cent showed primary healing.

Of the 20 large lesions, 10 have been clinically well five years or over; 59 per cent relative five-year healings, 50 per cent absolute five-year healings. Six died from metastases, in 5 the lip healed but the le-

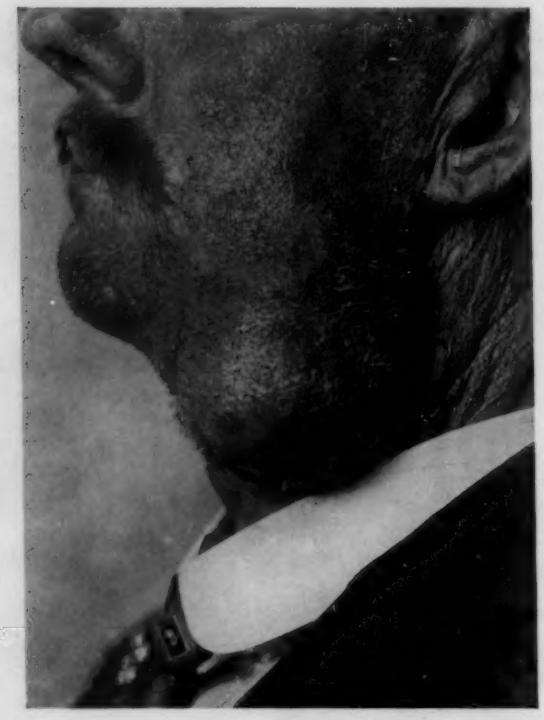

Fig. 7. Large submaxillary metastasis.

sion recurred before death; in one the lip never healed. One is living eleven years from the time of admission, is now well, but has not been well for five continuous years. One died from intercurrent disease after being well for four years and ten months. Two were lost trace of, both were clinically well. Seven in this group developed enlarged nodes which we thought might be metastatic, in 6 cases the nodes progressed causing death, in one case the nodes disappeared after treatment.

Of the 163 cases treated in Group 1, 77 are clinically well five years or longer, or 47 per cent absolute five-year healings; 107 are available for five-year statistics, of which 77, or 71.9 per cent, are relative five-year healings. Of the 157 cases which were followed at least once after treatment, 150, or 95 per cent, had primary healings. Nine of this 150, or 5.7 per cent of the total, recurred without subsequent healing.

Twenty-six of the cases (19.8 per cent) which were treated locally only, developed enlarged nodes. Eight of the cases (25 per cent) which were treated over the lymph-bearing areas, as well as locally, developed enlarged nodes.

Thirty-eight cases were placed in Group II (see Table II). Eight cases are clinically well for five years or longer, 29.6 per cent relative five-year healings, 21 per cent absolute five-year healings. Eighteen cases died from the disease, in 8 the lip was healed at the time of death, in one the lip healed but recurred before death. Six of these cases died between one and two years; 3, from two to three years; 2, from three to four years (1 of these cases was clinically well two years seven months when there was a recurrence on the lip and metastases); one, from four to five years; one, from five to six years, was clinically well four years ten months when there was a recurrence of the metastases, the lip remained well at the time of death. One case is living over five years, is now well but has

Fig. 8. Same case as Figure 7, nine months after treatment by high power roentgen rays.

not been continuously well for five years. Four cases died from intercurrent disease, 3 were clinically well from one to three years; one died in a month, the lesion had improved. Seven cases were lost trace of, one had been clinically well for six months, 13 were recurrent after local excision and dissection of the neck glands. In 25 of these cases the lip remained well at the time of admission but the metastases were hard and fixed. Only one of the 79 cases treated in Group III, or 1.2 per cent, is well for over

TABLE II
RESULTS OF TREATMENT OF 38 GROUP II CASES

	Lesions larger than 1.5 cm.—Nodes palpable on one or both sides of the neck —27 cases	Lesions 1.5 cm. or less—Nodes palpable on one or both sides of the neck—11 cases
Five-year healings Relative Absolute	6 cases—31% —22%	2 cases—25% —18%
Died from cancer	13 cases 1 clinically well 4 yr. 10 mo., recurrence of metastases, lip remained well; 1 clinically well 2 yr. 7 mo., recurrence on lip and metastases; 5 in from 1 to 4 years, lip remained well at time of death in 4 cases; 6 died in less than a year, unimproved	5 cases 1 clinically well 1 yr. 10 mo., recurrence of metastases, lip remained well; 4 died in from 1 to 3 years, in 2 cases the lip remained well at the time of death
Living over five years, now well, but not continuously well for five years		1 case
Died from intercurrent disease*	4 cases 3 clinically well for from 1 to 3 years; 1 unimproved—1 month	
Lost trace of*	4 cases 1 clinically well 6 months; 1 lip healed for 4 months, metastases remained the same; 2 undetermined—did not return after treatment	3 cases all in less than a year, lip healed in 2 cases

* Cases lost trace of and those who died from intercurrent disease are deducted from the total number of cases in estimating the relative five-year cures.

in 3 the lip was healed but the metastases remained the same, one case was unimproved, 2 were undetermined as they did not return after first treatment.

Primary healing was achieved in 25 cases, or 65 per cent, of the Group II cases.

Eighty cases were placed in Group III, 21 of these were recurrent after local excision, five years (absolute statistics). Discounting the lesions which were healed at admission, 11 of 54, or 20 per cent, showed primary healing, 2, or 18 per cent, of those healed, recurred.

CONCLUSIONS

1. This study includes cases treated between 1914 and 1927, and is based on

285 cases which were arranged in three groups according to the amount of anatomical involvement.

TABLE III
FIVE-YEAR RESULTS—EPIDERMOID LIP CARCINOMA

	No. of Cases	Primary Healing Per cent	Relative Five-Year Healing Per cent	Absolute Five-Year Healing Per cent
Not treated	4			
I—(a) No nodes palpable, lesion 1.5 cm. or less	82	99	85	56
(b) Lesion over 1.5 cm.	81	93	58	38
II—Nodes palpable	38	65	29.6	21
III—Inoperable	80	20	—	1.2
Total	285			

2. In the Group I cases 95 per cent showed primary healings, 2.5 per cent of which recurred without subsequent healing; 71.9 per cent showed relative five-year healings; 47 per cent showed absolute five-year healings. The small lesions treated locally only showed 85 per cent relative five-year healings, the large lesions treated locally only showed 58 per cent relative five-year healings; the small lesions treated locally and to the lymph-bearing areas prophylactically showed 86 per cent relative healings, and the large lesions in this group showed 59 per cent relative healings.

3. In the Group II cases 65 per cent showed primary healings, 29.6 per cent had relative five-year healings; 21 per cent absolute five-year healings.

4. In the Group III cases only one of 80 showed five-year healing; the rest died from metastases.

5. In the Group I cases, 34, or 20 per cent, developed enlarged lymph nodes.*

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* For discussion see page 88.

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TREATMENT AND RESULTS IN CARCINOMA OF THE LIP*

A REPORT OF 130 CASES

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IN PERHAPS no other malignancy is the physician in so favored a position as when dealing with carcinoma of the lip. The appearance of an ulcer on the lip that fails to heal, by virtue of its exposed and prominent position, leads to early recognition. Delays, for which physicians and patients are about equally responsible, occur, but not with the consistent frequency observed in the diagnosis of most other malignancies. In addition, carcinoma of the skin, of which cancer of the lip may be considered as one of the more frequent sites of occurrence, is relatively benign as contrasted with a large number of malignancies occurring elsewhere. In the management of carcinoma of the lip, the physician has at his disposal two agents of demonstrated value, namely, surgery and irradiation, and the results of effective treatment in early cases of carcinoma of the lip are probably unrivalled by those of any other type of malignant neoplasm.

The special interest in carcinoma of the lip hinges about the most appropriate type of treatment. For most squamous cell carcinomas of the skin elsewhere, irradiation in most centers where both types of treatment are available has superseded surgery. In the lip, however, the results of adequate, early surgery have been so satisfactory that many have been unwilling to substitute an agent of questioned equal worth. Several of those who have accepted the conservative plan of irradiating both the neck and the local lesion on the lip, however, believe that many lymph nodes are needlessly removed by surgeons who regularly do the complete operation, and contend that their results are just as good, and that irradiation spares the deformity of the lip occasionally resulting from surgical excision.

What every conscientious physician desires for his patient is the greatest degree of protection and assurance of complete eradication of the disease, with least danger to life. The matters of conservative nonoperative or surgical treatment with its attendant apprehensions, deformity and convenience are considerations of consequence, but only of secondary concern.

A number of studies have shown that when the submaxillary and submental lymph nodes are routinely removed in early cancer of the lip histologic metastatic involvement is present in only about 25 per cent of the cases. As contrasted with cancer of the breast or tongue, carcinoma of the lip must be conceded to be a more benign type of neoplasm in which lymph node metatases do not occur early with such regularity. Nevertheless the results of simple "V" excision and the complete operation [66 per cent five-year cures for the former, and 92 per cent for the latter (Brewer)] are so striking as to indicate that effectual and adequate management of the lymph nodes is a significant item in dealing with cancer of the lip. To those experienced in the removal of the lymphatic drainage area in malignancy, it is difficult to escape the impression that the assertion of the microscopist that the removed submaxillary or submental lymph nodes are free from cancer has the same significance as when he fails to find evidence of metastatic cancer in the axillary lymph nodes. Certainly the biologic test as manifested in the absence of lymph node

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involvement with the lapse of time is a far more reliable criterion than the statement of the pathologist that there is no microscopic evidence of metastasis. We have the impression as concerns the absence or presence of lymph node involvement in cancer of the lip, that palpation and gross examination of the removed nodes are almost as equally reliable in the detection of the presence of cancer as is microscopic examination.

Certain it is when the lymph nodes are manifestly involved that roentgen therapy as a single agent is a futile remedy. Our experience has been that surgical extirpation of the involved lymph nodes combined with the interstitial employment of radium emanations (gold seeds) is the most effective in such instances. From our own experience we have been unable to determine how effective roentgen radiation is in destroying minute metastases that are not apparent in the lymph nodes. Those who favor and practice this conservative plan have not published convincing statistics to bear out their contention. It might well be asked in how many early cases treated conservatively with irradiation does manifest involvement of the regional lymph nodes subsequently occur, demanding interstitial implantation of radium or surgical removal. We feel that one of the obligatory requisites in pursuing the conservative irradiation plan is a frequent (monthly at first) check-up of the patients. Our patients, though they come largely from an agricultural community, are in a measure a migratory population, as is easily demonstrated in follow-up efforts. They are almost entirely charity patients, and come from the four quarters of the state, and a monthly attendance at the outpatient clinic is, necessarily, out of the question. In consequence we have continued the policy of routinely excising the primary lymphatic drainage area in cancer of the lip. In the

TABLE I
RESULTS IN CARCINOMA OF THE LIP (130 CASES)
January, 1925—April, 1932

	Cases	Surgery Only	Irradiation Only	Combined Surgery and Irradiation	Recurrences	Total Deaths	Deaths Due to Carcinoma	Cancer-Free	
								3 years	5 years
Early without nodes (1)	41	16	8	17	1	8	4	10	5
Late with nodes (2)	53	9	6	38	10	6	5	12	2
Late with fixed nodes	5*			1	1	4	4		
PRIMARY GROUP TOTAL	99	25	14	56	12(11%)	18(19%)	14(14%)	22	7
RECURRENT GROUP TOTAL (3)	31**	7	11	11		16(51%)	13(42%)	4	3

FOLLOW-UP IN 84 PER CENT TOTAL MORTALITY—26 PER CENT MORTALITY DUE TO CARCINOMA—20.7 PER CENT

(1) 11 cases never returned after initial therapy.
(2) No follow-up on 3 cases.
(3) No follow-up on 5 cases.
* 4 hopeless. Not treated.
** 2 not treated

majority of instances the lesion on the lip has also been dealt with surgically, roentgen rays or radium being used as the sole therapeutic agents in very superficial localized, or very broad lesions of the lip. Our plan of dealing with the various types of carcinoma of the lip will be discussed at greater length below.

ticular therapeutic agent employed by the physician whom he consults.

REVIEW OF OUR MATERIAL

Since January, 1925, when the Cancer Institute of the University of Minnesota School of Medicine was opened, to April 1, 1932, 138 cancers of the lip have been

TABLE II

RECURRENT GROUP OF 31 CASES, 3 DIED WITHOUT EVIDENCE OF RECURRENCE AND WITH CAUSE NOT ATTRIBUTABLE TO CARCINOMA. THIRTEEN DIED DURING THE COURSE OF THE DISEASE AS FOLLOWS:

Age	Duration after Recurrence	Cause of Death	Treatment	Remarks
53	Unknown	Carcinoma	Not treated	Hopeless
42	10 months	Carcinoma	Not treated	Hopeless, due to extent and infection in neck
66	48 months	Carcinoma	Injection gasserian ganglion	Hopeless, recurrence in lip and neck
57	Unknown	Carcinoma	Radium therapy only	Hopeless, large ulcerated lesion —never cleared up
67	27 months	Asphyxia	Resection mandible	Recurrence in lip and neck, operative death
54	13 months	Atelectasis 27 days after operation	Neck dissection and radium implantation	Recurrence in neck
38	12 months	Carcinoma	1. Resection mandible 2. Later radium	Recurrence in neck never cleared up; died here 9 months later
65	50 months	Carcinoma	Combined surgery and x-ray and radium	Recurrence in lip and neck; died here 2 months later
70	33 months	Carcinoma	1. Combined surgery and irradiation 2. Later, irradiation	Recurrence in neck, never cleared up
74	20 months	Hemorrhage	Excision lip and irradiation	Recurrence in lip and neck, erosion jugular vein
70	22 months	Carcinoma	1. Combined surgery and irradiation	1. Recurrence in lip 2. Secondary recurrence
67	Unknown	Carcinoma tongue	Excision lip only	Recurrence lip
62	Unknown	Carcinoma cervix with metastasis to lung	Excision lip, neck dissection	Recurrence lip

One of the functions of a symposium should be a pooling of experiences, out of the discussion of which should be elaborated certain definite conclusions as to which is the preferred method of treatment. A review of this character fails in its objective unless this end is attained. With the cooperative effort in cancer treatment becoming manifest throughout our country, the patient should be in a position to accept the acknowledged preferred treatment and not be forced to accept the par-

studied. Eight of these cases refused all types of therapy, therefore the statistical study is based upon 130 cases.

Ninety-nine of these had received practically no treatment prior to admission and are therefore considered as primary cases. There were also 31 cases of recurrent lesions on the lip or neck, or both, when they first visited our Tumor Clinic of the Out-Patient Department. One hundred and eleven of these patients have been followed at fairly regular intervals, either by return visit,

letter, or through correspondence with their local physicians. We have therefore maintained an 84 per cent follow-up in this group. Fifteen of the primary and 5 of the recurrent group have not been traced for the last six months.

Age. The youngest patient in the whole group was thirty-three years old, and the oldest, a female, was ninety years. Thirty-four per cent were in the sixth decade, and 25 per cent in the fifth decade. We had only 3 cases below forty years of age.

Sex. There was the usual striking predominance of males over females, there being only 4 cases, or 3.1 per cent, of carcinoma of the lip in females in the group.

Position. In this series the upper lip only was involved in 2 cases (1.6 per cent). One of these, in a man, was diagnosed as basal carcinoma, and the other, in a woman, as an infiltrating type of squamous carcinoma. There was no predominance of one side of the lower lip over the other.

When these cases were first seen, a biopsy was taken and a careful microscopic study made. The various sections were graded upon the cellular differentiation as pointed out by Broders. We have felt that microscopic grading is another aid that must be considered carefully in appraising the prognosis. We have not, however, varied the treatment a great deal whether the tumor is graded 1 or 4.

The clinical factors have proved to be of greater aid to us than any laboratory procedure. In every case we have tried to make special notation as to the extent of the primary lesion, whether it is infiltrative or proliferative, and the presence or absence of palpably firm, discrete, regional nodes (clinically or at operation). Not infrequently it has been our experience that palpable nodes have failed to show microscopic evidence of disease. Our usual procedure, however, has been to make sections of each node present. Possibly if a large number of sections of each node were made we would find more nodes with microscopic involvement, but such procedures are impractical.

THE PRIMARY GROUP

Duration. The duration of the lesion in these cases varies from six months to over five years. There were 22 cases with the duration less than six months, and the same number with the duration over four years.

Grouping of Cases. Cases of this group have been subdivided into three classes depending upon the presence of involved nodes, clinically or operatively, and if they were fixed to surrounding structures or nodes. The fixation probably means that the carcinomatous metastasis has broken through the capsule of the node and invaded the neighboring tissues. The primary lesion has been of the infiltrative type in 88 cases, and proliferative in 11 cases.

There were 41 cases of early lesions without regional nodes being involved; 53 cases in which the nodes were palpable, and 5 cases in which the nodes were fixed.

EARLY LESIONS WITHOUT PALPABLE NODES

The primary lesion was of the infiltrative type in 38 cases and of the proliferative in 3 cases. In the class of early lesions without involved nodes the duration was fairly short. In 9 cases the duration was less than six months; in 12 the duration was between seven and twelve months; however, the lesion was present over four years in 8 cases.

We have employed no inflexible rules in the management of these cases of carcinoma of the lip, but have permitted ourselves to be guided largely by the findings in each case. The usual treatment has been a combination of surgery and irradiation. Latterly we have been treating the local lesion more frequently by irradiation alone. The lesion on the lip has been first excised by a wide "V" type of incision, followed by one exposure of the lip to roentgen radiation (30–50 per cent S.E.D.). In those instances where the excision of the lesion has narrowed the oral opening considerably, we have found that a lateral incision on one or both sides usually suffices to correct the deformity. In previous years we usually employed the Stewart operation for recon-

structing the lip and in more recent years a pedicled lateral flap swung down from the upper lip has occasionally been employed. However, we have found the widening of the mouth obtained by suturing the mucous membrane in the lateral incision (Fig. 1) so effective and simple as to warrant its routine employment where a plastic repair appears indicated. After about four weeks a neck dissection has been done in which the contents of both submaxillary triangles and the submental space have been excised. Whenever indicated, as determined by the presence of manifest gross involvement of the submaxillary lymph nodes on one or both sides of the neck, a block dissection has been done. When the incision has healed a series of deep roentgen treatments (120–160 per cent S.E.D.) have been given. Roentgen radiation to the lip alone has been limited largely to very superficial lesions, the removal of which would demand excision of practically the entire lower lip.

The majority of the cases have been treated in this manner. There have, however, been several that have had surgical treatment only, and a few that have been treated by radiation alone. In those instances in which the lesion on the lip responded favorably to roentgen or radium irradiation alone, excision of the submaxillary and submental lymph nodes has almost invariably been done a short time later, followed by roentgen irradiation of the neck. We have not employed the endotherm, but have used sharp dissection throughout.

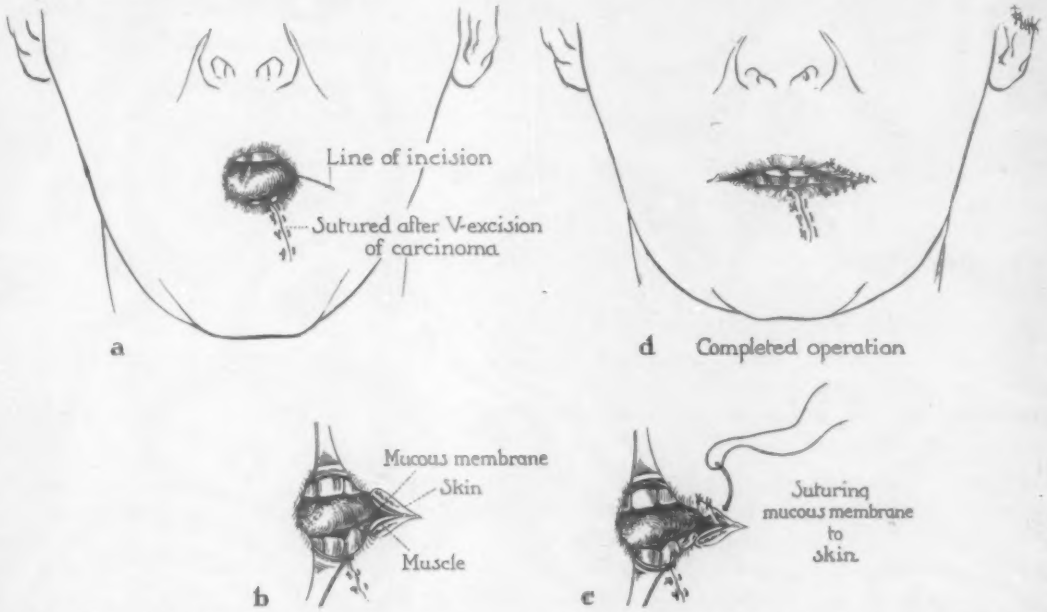

FIG. 1. A simple method of enlarging the "fish-mouth" deformity after "V" excision of a lesion of the lip (O.H.W.). The method may be employed, also, in the rarer instances of carcinoma of the upper lip. We have also found it useful in enlarging the oral opening after unsatisfactory results following more complicated types of plastic repair.

The combination of surgery and irradiation has been used in 17 cases; irradiation alone in 8 cases; surgery alone in 16 cases (in 4, only excision of the lip was done).

One case did not improve after irradiation of the lip and regional nodes, and died twenty-two months after treatment. There was one recurrence in the lip thirty-two months after excision of lip and neck dissection. This recurrence was treated by roentgen irradiation of the lip and neck. He

was free from tumor when seen two months later.

Mortality. There have been 8 deaths, 4 of which were not attributable to cancer who died eight months, nine months, twelve months, and thirteen months after initial therapy. The 4 who died, whose cause of death could be attributed to carcinoma, lived three days, two months, nineteen months, and twenty-two months after initial therapy (see Table III).

more than four years in 13 cases. When we compare these figures with the early group the duration does not appear to be of very much importance.

The primary lesion was of the infiltrative type in 45 cases, and proliferative in 8 cases.

In this group there has been a much stronger tendency to combine surgery with irradiation. In only 9 cases was surgery used alone, in 6 cases irradiation alone, and in 38 cases the combination

TABLE III

THE DEATHS MAY BE TABULATED AS FOLLOWS: PRIMARY GROUP OF 99 CASES, 18 DEATHS, 4 DIED OF CAUSES NOT ASCERTAINED BUT WITHOUT EVIDENCE OF RECURRENCE. FOURTEEN DIED DURING THE COURSE OF THE DISEASE AS FOLLOWS:

Age	Duration after Treatment	Cause of Death	Treatment	Remarks
60	3 days	Hemiplegia	"V" excision lip	
75	5 days		Submaxillary neck dissection	Postoperative death
61	4 months	Carcinoma	Not treated	Hopeless, due to infection
85	8 months	Carcinoma	Radium only	Hopeless. Very extensive
80	1 month	Melanoma	Excision lip, irradiation	Hopeless
80	Unknown	Carcinoma	Irradiation only	Hopeless, due to extent and senility
78	Unknown	Carcinoma Recurrence	Irradiation, neck dissection	Recurrence, 8 months after initial therapy
71	15 months	Carcinoma Recurrence	Combined surgery and irradiation	Recurrence lip and neck, treated with radium and x-ray
72	4 months	Carcinoma lung (metastasis)	Combined surgery and irradiation	No recurrence in lip or neck
66	22 months	Carcinoma	Irradiation	Never completely healed
68	19 months	Carcinoma larynx	Excision lip and neck dissection	No recurrence
—	4 months		Excision lip and neck dissection	
66	7 days	Carcinoma	X-ray and radium	Died at home
72	2 months	Carcinoma	Excision lip and x-ray lip	Died at home

Of the remaining cases we have no follow-up on 11 who never returned after they were first treated. The duration of the other 22 cases is as follows: up to six months, 6 cases; seven to twelve months, 2 cases; thirteen to eighteen months, 1 case; nineteen to twenty-four months, 3 cases; twenty-five to thirty-six months, 4 cases; thirty-seven to forty-eight months, 1 case; over forty-eight months, 5 cases.

CARCINOMA OF THE LIP WITH PALPABLE NODES

Duration. There were 53 cases in this group. The duration did not appear to be of very great consequence as the duration was less than six months in 14 cases, and

of surgery and irradiation was employed.

Recurrence. We have had 10 recurrences of which 2 were in the lip, 3 in lip and neck, 3 in neck, and in 2 the position was not stated. Most of these recurrences appeared during the first six months subsequent to treatment, however one appeared after three years. Six of the cases are dead, 2 of which died during treatment.

ADVANCED GROUP

Of the 5 cases in the advanced group, 4 were considered hopeless and no treatment was advised. In the other case a combination of extensive dissection followed by deep roentgen therapy was used. A recurrence in the neck appeared two months

later which was treated, and the patient is now living and well twenty-seven months after the first treatment.

SUMMARY OF RECURRENCES IN PRIMARY GROUP

There were 12 recurrences in the primary group, 7 of which appeared within the first six months, 2 between seven and twelve months; 2 between twenty-five and thirty-six months, and 1 after thirty-six months. Four of the recurrences were in the neck, 3 in the lip, 3 in the lip and neck, and in 2 the location of the recurrence was not stated. Ten of these cases were living with recurrences under control when last seen.

RECURRENT GROUP

There were 31 cases in this group, and all had their primary lesion in the lower lip. Their initial treatment elsewhere consisted of surgery only, in 15 cases, irradiation only, in 8 cases, and surgery and irradiation in 8 cases.

Duration and Position of Recurrence. Upon admission the recurrence was present on the lip in 14 cases; in the neck in 11 cases, and lip and neck in 6 cases. These lesions had been present less than six months in 16 cases, between seven and twelve months in 6 cases; thirteen to eighteen months in 2 cases; nineteen to twenty-four months in 2 cases; two to three years in 1 case; three to four years in 2 cases, and no record was given in 2 cases.

Four of these cases were considered too far advanced to be treated other than palliatively. In 7 the recurrence was treated with surgery only, in 11 cases with irradiation only, and in 11 with a combination of surgery and irradiation. All but 5 of these cases have been followed. Sixteen are dead, of which the cause in 13 is known to have been cancer.

Of those who have been traced, 3 are free from symptoms less than six months; 1 is free less than one year; 2 less than eighteen months; and 4 have been free for more than three years.

Upon the basis of the 31 cases in this group, the mortality has been 16 cases, or 51 per cent.

SUMMARY OF RESULTS (SEE TABLE I)

In the 99 primary cases, surgery was used alone in 25 cases; irradiation alone in 14 cases; and a combination of surgery and irradiation was employed in 56 cases. There were 4 cases considered hopeless and not treated. There were 12 recurrences of which 2 are dead, and there was one case who was unimproved and subsequently died. One of these recurrences was in the early group, 10 in the group with involved nodes, and one in the advanced group. There were 18 deaths (mortality 19 per cent), 14 of which were attributed to carcinoma (mortality on this basis of 14 per cent). We have no follow-up in the last six months on 14 cases. In this primary group there are 22 cases that have been followed who are living and free from symptoms three years after initial treatment, and 7 of which are living and well five years after treatment.

In the 31 recurrent cases no treatment was advised in 2 cases; surgery was used alone in 7 cases; irradiation alone in 11 cases; and a combination of surgery and irradiation in 11 cases. Fifteen cases are now free from symptoms, 4 of which have gone more than three years since their initial treatment. There have been 16 deaths, 13 of which may be attributed to carcinoma.

SUMMARY AND CONCLUSIONS

The results of treatment for cancer of the lip compare favorably with those of any malignancy. Failures are usually due to delay in receiving adequate treatment. In this group of 130 cases there have been 34 deaths (26 per cent); in 26 instances (20.7 per cent) death was due to cancer or a cause associated with the treatment of the lesion. Surgery has been the mainstay of treatment and roentgen rays and radium have been employed as essential adjuncts. It is believed that surgical removal of the submental and submaxillary lymph nodes affords the patient, with an early lesion, more protection than conservative irradiation.*

* For discussion see page 88.

AN OPERATION FOR EPITHELIOMA OF THE LIP*

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THE purpose of this paper is to present a type of operation which is useful in cases of primary epitheliomata involving a moderate or considerable portion of the lower lip. There is no attempt to discuss the treatment of neck metastasis.

With increased skill in the therapeutic application of radium and roentgen rays, with new and more effective methods of making use of these agents, with larger amounts of radium available in some institutions, and with higher powered roentgen-ray machines, in certain instances it is possible to eradicate the primary lesion by these means, and to cause but little alteration in the appearance and in the function of the lip. All too often, however, the dosage available is insufficient, and the physician employing these agents is not adequately trained in their proper application, with the result that in many instances the disease is not arrested.

Thorough surgical treatment is better than ineffectual radiation therapy, and inadequate excision is worse than optimum treatment by radiation. Interference with insufficient treatment by either method stimulates the diseased tissue to increased activity. As a result, subsequent eradication is rendered more difficult; a larger amount of tissue must be excised; the neoplasm may become widely disseminated; and finally, the cosmetic and functional results of later operations are relatively poorer.

A microscopic examination should be made of all primary lesions; for only with the data found thereby can the nature of the diseased tissue be definitely known and the diagnosis of malignancy be confirmed or disproved. An excision of the primary lesion with a wide margin of safety combines biopsy and good therapy.

It is essential in surgical excision of the primary epitheliomatous lesion that a sufficiently wide margin beyond the lesion be excised to prevent the possibility of leaving any portion of the diseased tissue *in situ*. Should not all of the tumor be removed, reappearance is bound to occur. One should not, therefore, be influenced by the size of the defect resulting from such a wide excision. The primary consideration is the elimination of the disease; secondary to this is the desire to obtain a satisfactory cosmetic and functional result.

Many small primary lesions may be readily repaired by simple "V"-shaped excision. This operation may be performed in the office or dispensary, under a local anesthetic, by an unassisted operator if necessary, and the patient does not have to enter a hospital. The stitches may be removed early, without leaving deforming scars, and the appearance of the lip is practically unchanged after this procedure. Even somewhat larger lesions may be excised by the "V"-method. This may leave a temporary tightness of the lip, but the deformity will be overcome in time by the gradual stretching of the lip from daily use.

There is a limit, however, to the width of tissue which may be excised without leaving a permanent deformity. Excision of larger lesions involves the problem of tissue replacement, and countless methods have been devised to repair these defects. In many of these operative procedures a portion of tissue is transplanted from the cheek, the chin, or from the neck, and the mucous membrane is brought over as well as possible to form a new vermilion border and a lining of the new lip. With many of these procedures, tissue from the cheek is drawn in from the sides and a tight lower

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lip is produced. This traction of tissue towards the median line, in order to form the lower lip, inevitably draws the outer edges of the upper lip more closely together and causes this lip to protrude beyond its natural position. There then exists a tight, retracted lower lip and a relaxed upper lip projecting beyond it.

The operation here described prevents this discrepancy between the two lips and replaces the tissue which has been excised with tissue similar in structure and appearance. It consists in turning a wedge-shaped flap from the upper lip to fill one half of the "V"-shaped space caused by excision of the lower lip together with the epithelioma.

The operation is usually done under local anesthesia, by injecting the infraorbital and mental foramina. The pedicle, attached to one corner of the flap at the lip margin, may either be bridged across between the two lips and severed at a subsequent operation, or the pedicle may be used to form the new commissure of the mouth.

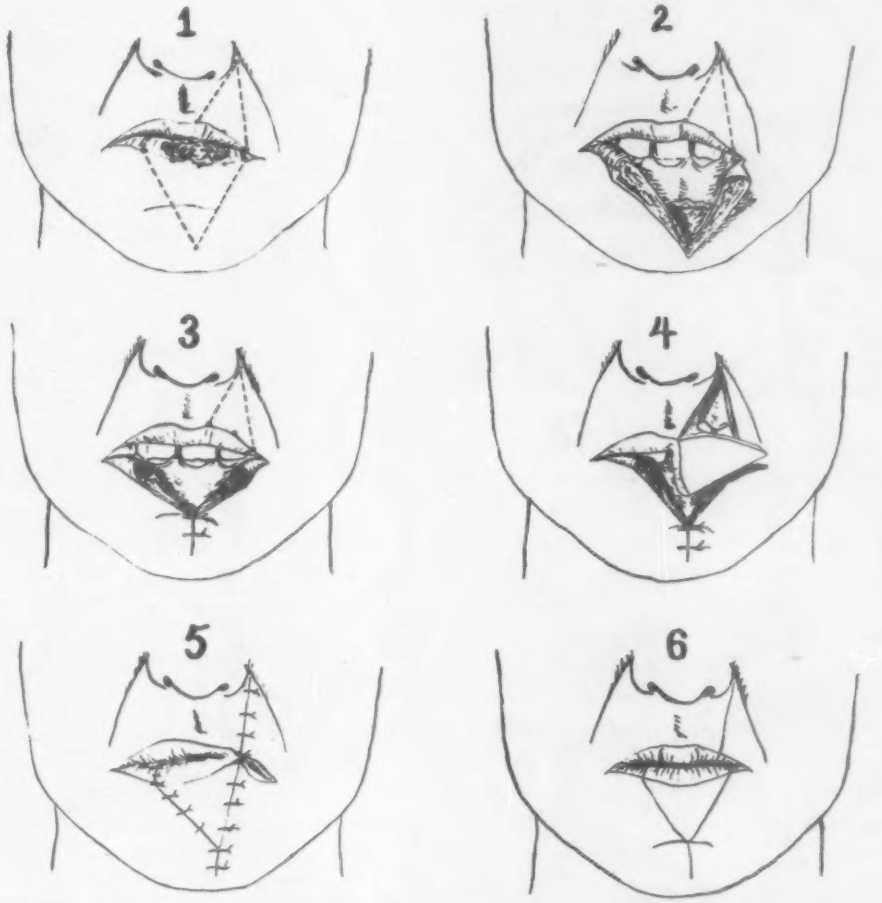
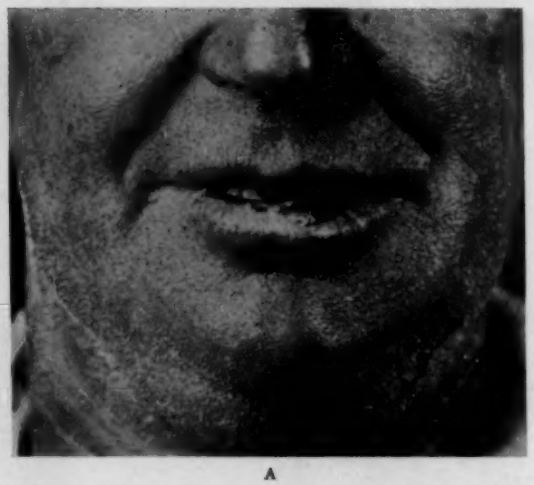


Fig. 1. Steps of operation for rotation of upper-lip flap into lower-lip defect, with the pedicle bridged between both lips. (1) Epithelioma and outlines of incisions in lips; (2) Epithelioma excised and muscle overlying the chin undermined; (3) Skin and mucous membrane sutured up to the level of the labio-mental fold; (4) Upper-lip flap being rotated into the lower-lip defect.—Note that the skin and lip margin are severed on the outer side. On the inner, pedicle side, the incision is carried through the skin to its junction with the vermilion border and the mucous membrane is left intact at a higher level; (5) Flap sutured in position with all denuded surfaces covered over. The pedicle forms a bridge between the lips making two openings to the mouth; (6) Pedicle severed and lip margins reformed.



A

Fig. 2. Case 1, illustrative of upper-lip pedicle bridged between both lips. A. Epithelioma appearing in two portions of the lower lip, before operation.

This type of operation has been in use for at least ninety-five years. In so far as investigation has disclosed, Pietro Sabattini of Italy was the first to devise this method.[1] In 1837 he successfully used a pedicled lower-lip flap to repair an upper-lip defect, in a case where the upper lip and the nose had been slashed off with a sabre.

Sophus August Vilhelm Stein of Copenhagen[2] in 1847 excised a large epithelioma of the lower lip and turned down two adjacent flaps from the middle of the upper lip, each flap having its own pedicle situated laterally. Three openings were thus made in the mouth, as the adjacent edges of the rotated flaps and those of the upper-lip defect were not sutured at the first operation, but these edges were freshened and approximated subsequently when the pedicles were severed. Stein's method was with much reason both praised for its ingenuity and condemned[3,4,17] for its complicated technique and for the tendency of its pointed, narrow flaps to slough.

B

Fig. 2. Case 1, illustrative of upper-lip pedicle bridged between both lips. B. Front view, five months after division of the pedicle.

In 1863 Gurdon Buck of New York[5,7] used a flap from the right side of the lower lip, pedicled at the vermilion border and adjacent skin, to fill a defect caused by noma in the right side of the upper lip. Later in that decade he performed other similar operations.[6,7]

C

Fig. 2. Case 1, illustrative of upper-lip pedicle bridged between both lips. C. Postoperative profile view, showing the normal appearance of the lips.

J. A. Estlander of Helsingfors[8] reported in 1872 that he had independently devised and for several years had used an operation whereby a flap from the outer border of the upper lip was rotated to fill a defect in the outer border of the lower lip after ex-

cision of an epithelioma. The pedicle formed the new commissure of the mouth. Estlander published several articles in various languages[9,10,11] and went much more deeply into the mechanism of the operation than any author before or since his time.

In 1898 Robert Abbe of New York[12] reported the use of a wedge-shaped flap from the lower lip pedicled with lip margin and skin to increase the amount of tissue in a tight upper lip, caused by repair of a dou-

A

Fig. 3. Case II, illustrative of the operation employed when the epithelioma is located near the commissure of the mouth. The pedicle forms the new commissure. A. Cast showing the epithelioma and the lines of incision.

ble harelip. The pedicle was bridged between the lips. He left a portion of the pedicle, the flap and both lips denuded, and subsequently, after freshening the edges, severed the pedicle and approximated the adjoining edges.

G. Neuber of Kiel[13] briefly reported in 1899 an operation identically similar to Abbe's. Lexer speaks of it as the "Abbe-Neuber" operation,[19] but Abbe, preceding Neuber, had already done much to popularize it. This type of operation has been extensively used—notably in this country

B

Fig. 3. Case II, illustrative of the operation employed when the epithelioma is located near the commissure of the mouth. The pedicle forms the new commissure. B. Condition three years after the operation of rotating the upper-lip flap and later of widening the mouth.

by T. W. Brophy—for the relief of a tight upper lip.

Vilray P. Blair and his assistant, J. Barrett Brown, of St. Louis,[22] have seen the

C

Fig. 3. Case II, illustrative of the operation employed when the epithelioma is located near the commissure of the mouth. The pedicle forms the new commissure. C. Profile view showing normal lip contour.

value of leaving none of the cut edges denuded, and the operation described here is largely based on their technique. Many others have described the methods or

A

Fig. 4. Case III, illustrative of the release of a tight lower lip caused by Bürow's operation for reforming the entire lower lip. A. Profile view before the release operation, showing the lower lip so tightly retracted that a dental plate could not be worn in the edentulous mouth.

have reported cases operated by the methods of the various men mentioned above.[14,15,16,17,18,19,20,21,23,24]

In the operation recommended here, a wedge of tissue in the form of an isosceles triangle, containing the epithelioma and leaving a wide margin beyond it, is excised from the lower lip. The mucous membrane on the lip side of the sulcus is incised laterally. The muscular tissue of the chin is separated from its attachment to the mandible and the lower portion of the "V" is brought together with sutures as far as the mento-labial fold.

When the lesion does not involve the commissures, a wedge-shaped flap is cut from the upper lip in the form of an isosceles triangle. Its base is at the vermilion border, equal and opposite to the right (or left) half of the defect in the lower lip, as previously marked out, and its apex is at the naso-labial fold; its height is equal to the distance between the mento-labial fold and the vermilion border of the lower lip. Section is made through the entire vermilion border and lip margin on one side of this wedge-shaped flap of the upper lip. Tissue is left at the other lip margin of the flap to form the nutrient pedicle; the incision is carried down superficially on this pedicle side to the junction of the skin and vermilion border, but the mucous membrane is preserved at a higher level so as to leave intact the superior coronary artery to maintain nourishment to the flap.

The upper-lip flap is then rotated downwards 180° and the opposing edges of skin and of mucous membrane are approximated with interrupted sutures. The defect in the upper lip is closed in like manner and the skin of both the upper and lower lips is brought together at its junction with the

B

Fig. 4. Case III, illustrative of the release of a tight lower lip caused by Bürow's operation for reforming the entire lower lip. B. Profile view after increasing the size of the lower lip by a flap from the upper lip. For comparison no dental plate is worn.

vermilion border. The denuded areas of the pedicle are completely closed over by suturing adjacent edges. This constitutes one of the important features of this operation, because no granulating surfaces or cicatricial contraction can occur after such approximation.

The patient is fed for the first twenty-four to forty-eight hours on fluids given through a tube, and mouth washes are given by the same means. Spoon-feeding and soft diet may then be given with later progression to regular diet.

Beginning about the tenth or twelfth day the pedicle is compressed at intervals by a rubber-covered clamp for increasing periods of time to stimulate the ingrowth of blood vessels to the flap from the adjoining lip tissue. The pedicle is severed about the sixteenth or seventeenth day after operation and the denuded areas on the lip margins are closed by utilizing the tissue of the pedicle.

Should the lesion be located near one of the commissures of the mouth, the pedicle can be used to form the new commissure, as in the operation of Estlander. This tends to shorten the mouth slightly on that side, and a subsequent operation to widen the mouth may be necessary, so that the two sides may be equal.

In those cases where a very extensive lesion has previously been excised and the defect closed by another procedure, which has left a greatly tightened lower lip and a protruding upper lip, the lower lip may be divided so as to form a wedge-shaped defect by the retraction of the tissue on either side of the incision. A flap may then be rotated down from the upper lip to fill this defect, as in the operation first described above.

The tissue of the flap from the upper lip in all of these instances is similar in every way to the remnants of the lower lip on either side of the operative defect. There may be some temporary lymphatic stasis causing a swelling of the flap, but this subsides in time, and the late appearance of the lower lip is satisfactory. The upper and lower lips assume their natural position with no abnormal protrusion and the profile is hardly changed after this procedure. The functional result is excellent and the cosmetic appearance good. Such a procedure in the hands of a competent surgeon is to be advised where no expert radiologist with effective equipment is available.

SUMMARY

1. Radiation therapy for primary lip epitheliomata may be dangerous unless in expert hands with sufficient dosage.

2. Biopsy of all lip lesions should be made.

3. Excision with a wide margin combines biopsy and good therapy.

4. Simple "V"-excision suffices for small lesions; larger lesions require tissue replacement.

5. An operation is described whereby a vermilion-bordered, upper-lip flap is rotated into a lower-lip defect of twice its size.

6. Depending upon the location of the lesion, the pedicle may bridge between the lips or may form the new commissure of the mouth.

7. Tight lower lips caused by other procedures may be released and brought forward by this operation.

8. Where radiation therapy might fail, the primary lesion may be eradicated surgically by this method with good functional and cosmetic results.

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DISCUSSION OF SYMPOSIUM ON CANCER OF THE LIP

Dr. Alton Ochsner, New Orleans, La. I hesitate to get up before this august group, a mere surgeon, and open the discussion on the treatment of carcinoma of the lip. Here in New Orleans we have been handicapped by having a relatively small amount of radium and our treatment is based largely on that fact. We have been forced to treat these cases operatively. We prefer in the cases in which the lesion is small, smaller than 1 cm. in diameter, to do a V-excision. For the larger ones we have used a modification of the Stewart incision. In all cases, whether treated with radium or not, we have always done a bilateral block excision of the glands of the neck. We have done this because we have found that 82 per cent of the cases were in Groups I or II and we felt that it would be better to do a block dissection. All of our patients at the Charity Hospital are impossible to follow and it is difficult for us to draw many conclusions concerning the end-results. We have felt that because of this lack of observation we were probably doing the better thing by extirpating as rapidly as possible the glands of the neck in those individuals. I cannot report on the end-results because of the fact that we deal with a peculiar class of individuals. We get them from the bayous of Southern Louisiana and many of them have never been away from the bayous before and never will be again. It is only when we get bad results that we get them back. Unfortunately, many of the cases are hopeless from the beginning. We try to clean them up as well as

possible but the results are not satisfactory.

Dr. Rollin H. Stevens, Detroit. This wonderful symposium on cancer of the lip can only result in a very pertinent influence on all of us in our decision as to how these cases should be treated. It emphasizes several things. First, the necessity for a more uniform system of keeping our records. It seems to me this Society should either adopt the system of the American College of Surgeons or cooperate with them and adopt a new system. There are so many different factors entering into the pathology and treatment of cancer of the lip with varying results, as exhibited by statistics, that it is difficult to come to any conclusions from statistics alone. When we get many more statistics than we have now relating to cancer of the lip treated by surgery alone or by radiation alone, treating the lymph nodes by surgery or not at all, or by irradiation, perhaps we may draw some definite conclusions.

I think we can draw one conclusion from what we have heard today, and that is that the radiation treatment of the primary growth is the treatment of choice. While we have seen some beautiful work presented here in regard to plastic procedures on cancer of the lip, and some splendid statistics from this treatment, at the same time all that surgery seems to be quite unnecessary. I think we should regard it as interesting pathologic or biologic experimentation. We certainly get beautiful cosmetic results from proper irradiation, and why take up the patient's time with hospitalization, and why strike fear to his heart by telling him of the time he must spend in the hospital when proper treatment with irradiation will produce equally good or better results.

In the treatment of the glands of the neck we have a different proposition. I have not been able to decide which is the better method, but have used both methods. Just before I left home a patient, who had had carcinoma of the floor of the mouth with metastasis to the cervical gland which we had treated seven years before with radium, came in with a recurrence of involvement of a cervical gland in the same neighborhood. The involved gland only was removed at the time of the first treatment and was found to be a squamous cell growth. A second nodule appeared there later. We treated the neck with radium packs and the patient remained well seven years until a few weeks ago when the late recurrent nodule appeared in her neck. I presume it is malignant but I did not have it removed and cannot prove it. I treated it with a radium pack only.

In another case of squamous cell carcinoma of the lower lip, which we treated by irradiation six years ago, a second carcinoma developed in the upper lip on the opposite side a few weeks ago. This growth disappeared promptly under roentgen irradiation. About two months later we found a gland at the angle of the jaw on the same side. Did that gland come from the growth on the upper lip or from the original growth on the lower lip of the opposite side? A block dissection of the neck was made and two small glands were found. These proved to be squamous cell metastases. It is very difficult to determine the nature of glandular involvement whether inflammatory or metastatic. As was pointed out, we must remember that metastasis follows along the glands, and if the latter are removed metastases, theoretically at least, are not so likely to occur. We should have more conferences on this subject, particularly on the treatment of glands of the neck.

Dr. M. Lenz, New York City. There is one type of treatment of glands of the neck that has as yet not been mentioned, and that is the treatment by molded radium packs, according to the method used at the Curie Institute. At the Presbyterian Hospital where Dr. Webster and I frequently collaborate in the treatment of carcinoma of the lower lip we have adopted a few general principles which we follow in the majority of instances. Cases in which glands are not palpable are carefully followed clinically, but not treated in any other way; cases with palpable irremovable glands are treated by molded wax packs of radium at a 6 cm. distance from the skin; cases with palpable glands which can be removed have a unilateral upper neck dissection done, unless the lesion is in the midline, when a bilateral upper neck dissection is done. If the glands are proved microscopically to contain cancer, a lower neck dissection on that side is done in addition. As far as the treatment of the primary lip lesion is concerned Dr. Webster usually resects the more superficial carcinomas which are less than 1 cm. in diameter, whereas the larger and deeper ones are generally referred for radium therapy.

Dr. W. E. Costolow, Los Angeles. One point I do not think was mentioned today in speaking of neck gland dissections is whether or not the surgeons precede this by thorough external irradiation. We believe this is an important point. In our clinic it is not our custom

to do routine neck gland dissections in carcinoma of the lip, but in cases in which this is done we always precede the dissection by thorough external irradiation, the dissection being carried out at least six weeks afterward. This procedure certainly will add something to the final results.

DR. OSCAR L. NORSWORTHY, San Antonio, Texas. There is one point that has not been brought out, although everyone treating cancer of the lip or mouth probably practices it, and that is cleaning the mouth. Practically all lip malignancies are associated with bad teeth, bad gums or some other foul condition of the mouth; and we are careful to put teeth and the entire mouth in good condition before discharging cases of cancer of the lip.

With reference to block dissection as against irradiation of the neck in cancer about the face, there are arguments for and against. I do not know whether we can go home with that question decided. There are good points on both sides of the question, and neither method of treatment is positive assurance against extension of the disease.

DR. LUND (*closing*). I have not been asked any direct questions, and do not know how the other men will answer, but in regard to the last subject that was brought up by Dr. Norsworthy, cleaning up the mouth, I agree that this is important and that we in Boston have paid too little attention to it. In the lip cases I think we do not pay attention to it at all, but in the mouth cases we have done so.

Preoperative roentgen therapy was not given in the cases I reported, and is still not being given at the Huntington Memorial Hospital in all the lip cases. It is in the mouth cases.

Dr. Lenz mentioned the palpability of the glands. That is open to discussion. If you place the fingers of one hand inside the mouth and part of the other outside there are very few individuals in whom you cannot feel normal glands. I do not know in speaking of palpable glands whether it is meant that they are normal or enlarged by infection or disease. I divide my cases for that reason so that we can say that in the group with enlarged glands of 1 cm. and over the glands probably have cancer cells in them.

To show the method of this study, during the last two days before I left Boston I had worked out in 147 cases a comparison of the five, four, three, two and one year end-results. With the surgical cases there was a surprisingly close correlation with the one year to what we had at the end of five. That of the radium treated cases was not so good because we were using entirely inadequate irradiation, only enough to hold them in check for three to five years. That report will be published and I hope will be useful to those who are not able to get five-year results, and also to us who are using five-year results as a preliminary test, for it is hard to wait five years when the world is going ahead as fast as this symposium shows it is.

DR. MATTICK (*closing*). I think the question is still debatable as to the best methods of treating the primary lesions, either good surgery or good radiation seems perfectly feasible, whichever happens to be the best available. When it comes to the metastatic lesions, whether metastatic presumably or proved, there it seems we need a combination of good surgery and good irradiation. This latter group is the stumbling block it seems at present.

In the inoperable group where we get palliation only, I think the radiologists should refuse to treat the bad results of the surgeon, for he cannot get anything but palliation and that puts irradiation in an unfavorable light. I want to emphasize that dependency for causing regression in metastases cannot be placed on external irradiation alone. I do not wish you to think of one case I showed this afternoon as being the rule of roentgen therapy in this respect. With the radium pack we might get a little better results, but I doubt if any real increase in our five year cures.

Someone brought up the question of the expectancy of metastases in these cases. We have figured about 20 per cent of our apparently primary cases develop metastases later. I think Bloodgood shows 36 per cent when the glands were subjected to pathologic examination.

DR. WANGENSTEEN (*closing*). This has been an instructive symposium and I am grateful for the opportunity of taking part in it. I rather suspect that Dr. Lee's invitation to participate in the program was not extended without motive. Undoubtedly he realized full well the coercive persuasion of superior results obtained by methods other than those which we are individually employing.

From what I have seen and heard here today I am fully persuaded that the local lesion on the lip (after obtaining a small sliver of tissue for microscopic examination) is best treated with irradiation. From what I have heard I am not convinced, however, that the conservative plan

of dealing with the lymph nodes in cancer of the lip is the best. Those who advocate this plan are asking us to give up a plan of established and proved worth for another method of questioned equal merit. If they asked us to give up dealing surgically with the lymph nodes in cancer of the tongue, there would be far more logic in their contention, in that the results in cancer of the tongue when compared with cancer of the lip are poor, no matter what the method of treatment employed. For the patients that we see with cancer of the lip at the Cancer Institute at the University of Minnesota, I am persuaded that excision of the submaxillary and submental lymph nodes offers them more protection than irradiation.

In judging of the presence or absence of lymph node involvement, we know that the microscope is not infallible. It is true that in a large number of instances in which the regional lymph nodes are excised in cancer of the lip metastatic involvement fails of demonstration. How many of these, however, with complete eradication of the local lesion would subsequently have developed manifest metastases in the regional lymph nodes later had they not been previously dealt with? I wish to emphasize again the superiority of the biologic method (the lapse of time) over the microscopic in judging of metastatic deposits.

As far as the cause of cancer is concerned, we still know exceedingly little about it. As one of the speakers stated, it is commendable to clean up the mouth in all instances. Dr. Alton Ochsner informs me that oral cancer is rather infrequent in colored patients in whom syphilis is rather commonly found.

With the intense interest exhibited in cancer investigation from many methods of approach, one cannot escape the impression that something fundamental will soon be forthcoming to guide us in treatment. Until then, however, it is necessary to continue in this empirical fashion.

Dr. Webster (*closing*). I wish to reiterate one point, that biopsy should be done to determine what the lesion is, for if you have no microscopic examination of the lesion it is difficult to say whether you have cured a cancer by radium or roentgen therapy.

Another point is that if all of the men who are treating epithelioma of the lip were members of this Society and were able to keep up with the rapid progress which you are making in radiation therapy it might be all right for them to use it, but scattered over the country there are countless men who are attempting to treat epitheliomata with insufficient amounts of radium or current, or without adequate training, and as a result we are getting many recurrences. They are far behind you here and they cannot treat lesions successfully, as you can with your modern methods and equipment

THE ROENTGEN TREATMENT OF BRONCHIOGENIC CARCINOMA*

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THE increasing frequency with which malignant disease of the tracheobronchial tree has been recognized in the last few years is doubtless due to the increasing use of the bronchoscope in the differential diagnosis of pulmonary lesions, coupled with an increase in the number of roentgenographic examinations of the thorax. The bronchoscopist has learned by experience to distinguish many different types of lesions of the tracheobronchial tree, and also has learned the necessity of removing a piece of tissue for microscopic study from any lesion that appears to suggest a malignant process. By bronchoscopic and roentgenologic procedures it is now possible to recognize bronchiogenic carcinoma at a reasonably early stage. This improvement in diagnosis has brought with it the necessity and the indications for some method of palliative treatment.

Direct attack on the lesion by surgical diathermy through the bronchoscope is not advisable in most cases because the disease usually involves one of the main bronchi and extends beyond the limits of the bronchial wall. Since the lesion is usually more extensive than it appears through the bronchoscope, and smaller than the roentgenogram would lead one to infer, the technical difficulties of treatment through the bronchoscope are self-evident. A few surgeons have accomplished extirpation of bronchiogenic carcinoma, but because of the situation of the lesion and the difficulties of the operation, favorable results can hardly be expected in any large proportion of cases. Radium tubes may be applied directly to the lesion or imbedded in it, without undue difficulty, but the radiosensitivity of the normal bronchial mucosa is still too little understood to permit the application of radium as a routine with impunity. For these reasons we prefer to use roentgen rays in the treatment of bronchiogenic carcinoma.

The technique of applying roentgen rays now in use in the Section on Therapeutic Radiology of The Mayo Clinic is the result of a slow and careful process of evolution, and has been developed chiefly from a clinical point of view. At the outset treatment was given with the utmost conservatism because of the fear, which subsequently proved to be groundless, of producing roentgen injury to the lungs and mediastinal structures, and because of failure properly to select cases for treatment. Encouraged by the demonstration that the lungs and mediastinal structures can tolerate doses of roentgen rays which are within the limits of tolerance for the skin, and because of a more thorough knowledge of pleuropulmonitis, resulting from the work of Groover, Christie and Merritt, Tyler and Blackman, Evans and Leucutia, and Desjardins, we now do not hesitate to treat many patients to whom irradiation was formerly denied.

Since tumors of the bronchi are usually about 10 cm. beneath the skin covering the anterior surface of the thorax, and are relatively resistant to irradiation, and since the average anteroposterior diameter of the right side of the thorax, in which the majority of carcinomas in our cases have occurred, is about 23 cm., it is evident that roentgen treatment must be carried out at high voltage, and that the principle of cross fire must be adopted in order to deliver an

* Read at the Thirty-third Annual Meeting, American Roentgen Ray Society, Detroit, Mich., Sept. 27–30, 1932.

effective dose of roentgen rays to the lesion.

Even though the absorption characteristics of pulmonary tissue are at present imperfectly understood, our experience has shown that a four-field cross fire of the lesion, with one field through each hemithorax anteriorly and one through each hemithorax posteriorly, with the vertical beam directed toward the lesion, which usually lies 2 or 3 cm. from the sagittal plane of the thorax, is not only well tolerated by the average patient, but produces favorable clinical results.

Whether an increase in dose by application of radium in situ, as in carcinoma of the uterine cervix, may lead to better results is a problem which has not yet been sufficiently studied. On general principles, the danger of producing a radium effect in the bronchial wall is one that must be given serious consideration when planning the treatment.

With the facilities at our disposal the treatment of each field is carried out as follows: The roentgen rays are generated at 200 kilovolts and 5 milliamperes by a transformer with mechanical rectifier activating an air-cooled high-voltage Coolidge tube. The radiation emerging from a Failla drum tube-holding device is filtered through 0.75 mm. copper and 2 mm. aluminum. With this set-up, and at a target skin distance of 50 cm., the threshold erythema dose is produced in seventy minutes, and measured in air by the Victoreen dosimeter, equals 560 r. We have not had any experience with constant potential machines, nor have we tried any of the methods of protracted or fractional irradiation.

Because the tumor has been localized both by bronchoscopic and roentgenologic examination, administration of the necessary cross fire of the region is facilitated. Extreme care is used in arranging the patient and the roentgen tube to insure the correct direction of the vertical beam into the lesion. To avoid any chance of missing the tumor, large fields are used, and each beam of roentgen rays is applied at an angle of about 45° from the vertical.

Since some patients are extremely uncomfortable from dyspnea and irritating cough, it is essential to minimize systemic reaction and to avoid fatigue by dividing the treatment into sessions of moderate duration. Most patients can tolerate complete irradiation of one of the four fields each day. In some cases it is necessary to divide the treatment for each field into two or more sessions. A complete course of treatment, therefore, may require from four days to two weeks, depending on the patient's condition and ability to tolerate irradiation. Nausea and vomiting are seldom severe enough to require care, and are reduced to a minimum by the patient's abstinence from food for three hours before and after treatment. No remedy which we have tried has been efficacious in preventing or treating gastrointestinal reaction. After the four fields have been treated, some changes in blood pressure or destruction of the elements in the blood may occur, but have never been sufficient to cause any concern.

Shortly after cessation of the immediate reaction to the rays, most patients notice increased expectoration, sometimes of frankly purulent material, and subsidence of fever, followed in a few days by decrease of coughing, pain, and dyspnea. In all probability these effects are due to the action of roentgen rays on the inflammatory infiltrate surrounding the lesion, and on the mucus-producing glands of the bronchi. The radiosensitivity of these structures has been established by abundant clinical and laboratory experiments.

In about two weeks regression of the tumor begins, and the symptoms abate as regression proceeds. When these changes are slight, the dose effective in the tumor was too low. Improvement reaches its height about a month after treatment, and has almost run its course by the end of the sixth week. We feel, therefore, that symptomatic improvement, even if slight, indicates repetition of treatment, as it is almost invariably accompanied by organic improvement in the malignant process.

The technique of the second course of treatment, given about six weeks after the first, although essentially similar to the first course, is modified to suit the new data obtained by bronchoscopic and roentgenologic examination. If indicated, the second course is followed by a third course of roentgen treatment after two months.

From May 1, 1925, to January 1, 1931, at the clinic, diagnosis of primary malignant disease of the tracheobronchial tree was made in 71 cases by removal of tissue from the lesions in the bronchus through a bronchoscope. We have been able to keep in close touch with all of these patients, and the results obtained have been reported in detail elsewhere.

Sixty-one of the patients are dead, and of this number 32 received treatment at the clinic or at home. Those who received treatment lived from two weeks to four years after returning home; the average duration of life was slightly more than eight months.

The 29 untreated patients lived from a few days to thirty-one months after a positive diagnosis had been made, or an average of a little more than five months. This difference in the duration of life, with and without treatment, may have been due partly to the fact that certain of the latter group were not treated because of complications that made irradiation inadvisable. However, in most cases treatment was offered to patients regardless of the existence of pleural effusion or metastasis.

It is difficult, if not impossible, to determine the duration of symptoms of carcinoma of the bronchi, because of the possibility that, in many cases, pulmonary abscess or bronchiectasis may have antedated the malignant disease. In the cases in which treatment was given, however, the duration of pulmonary symptoms was approximately the same as in the cases in which it was not given.

One patient had radon seeds implanted into the bronchial growth after he left the clinic; he lived for four years. Two patients observed since January, 1931, have been treated by implantation of radon seeds into the bronchial lesion, but neither showed any evidence of beneficial effect. Ten patients who were treated only by high voltage roentgen rays are improved or are living and well from fifteen months to four years after treatment. Eight patients of this group received all treatment under our direction, and 2 were treated after returning home.

Even though the palliative results we have obtained in this group of cases are not brilliant, we feel that the employment of roentgen therapy wherever possible is justified, unless it is contraindicated by extensive metastasis or extreme weakness or cachexia.

SUMMARY

From May, 1925, to January, 1931, in 71 cases, primary carcinoma of the tracheobronchial tree was diagnosed by removal of tissue from the lesion through the bronchoscope. Twenty-nine patients did not receive treatment, and all of them are dead; the average duration of life was a little more than five months. Forty-two were treated with radium or roentgen rays, either under our direction or at their homes. Thirty-two of these lived for an average of eight months after a diagnosis had been made. Ten patients who received roentgen therapy alone are living from fifteen months to four years after malignant tissue had been removed from the lesions; the average duration of life has been twenty-three months.

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DIAGNOSTIC VALUE OF CHEST ROENTGENOGRAMS PRODUCED WITH HIGHER POWER FACTORS*

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A STUDY of the opinions of fifty general and chest roentgenologists with an average experience of eleven years and from different parts of the United States and Canada on the diagnostic value of chest roentgenograms taken with milliamperes varying from 100 to 1,000, with kilovoltages from 50 to 85, at exposure times from 1/4 to 1/120 second and at target film distances from 5 to 9 feet, shows a preference for those roentgenograms taken at 1,000 milliamperes, 1/30 to 1/40 second exposure, 7 to 8 foot distance with a penetration sufficient to produce the correct density over the entire lung field.

These fifty roentgenologists came to Iola Sanatorium, where the work was done, in response to an invitation and for the sole purpose of studying the relative diagnostic value of the films. They were asked to inspect and grade varying numbers of these films—some studied five series of each of the four subjects under investigation, others thirty, and a few a hundred.

It was explained to them that the experiment was designed to show the relative diagnostic value of chest roentgenograms having diverse degrees of contrast and density with various exposure time values and taken at different target-film distances.

They were told that the experiment was one of several conducted by members of the Committee on X-ray Apparatus and Technique of the American Sanatorium Association, and that the manufacturer had loaned the apparatus to a member of this committee in order that the practical value of high power chest technique might be determined.

The machine used was of the single phase pulsating type with milliamperage and voltage available at a maximum of 1,000 milliamperes at 85 kv. p.; the power line was a 300,000 circular mil conductor leading 75 feet to a 50 kv. w. transformer; the tube had an elongated focus with a projected focal area of $14\frac{1}{2} \times 16\frac{1}{2}/64$ of an inch; the time switch was of the zero potential type; the screens were of speed quality, and the films ultraspeed. The patients were adults of both sexes with ages from twenty to fifty-five, most of them having pulmonary tuberculosis. Their chests measured from 6 to 12 inches and their chest expansion varied from 1 to 6 inches.

CONTRAST

One of the four subjects investigated was the effect of different degrees of contrast on the diagnostic value of chest roentgenograms. It was, of course, understood that the lower the penetration, the greater the resultant contrast or tissue differentiation, other factors being adjusted to maintain the desired density. It was further understood that to secure maximum tissue differentiation without increasing the exposure time and without sacrificing density, milliamperes had to be increased.

Accordingly a set of four roentgenograms were made of the chest of each of 100 patients. The milliamperes used in making each set were 1,000, 500, 250, and 100. The kilovoltages were varied at each milliamperage setting enough to produce comparable densities. Time and distance remained uniform so far as was practical.

The roentgenologists individually and on different days reviewed from five to thirty groups of these sets of four. They knew that the films on each patient varied in milliamperage from 100 to 1,000 but they saw no technical data that would indicate the milliamperage used. They selected the one of the four films of each

* Read at the Twenty-seventh Annual Meeting, American Sanatorium Association, Colorado Springs, Colorado, June 7, 1932.

patient which in their individual opinion showed the most from a diagnostic angle.

After making this selection they tried to place the remaining three films in the order of their diagnostic value.

The following is a tabulation of their choices:

First place was given to 80% of the 1,000 ma. films
First place was given to 13% of the 500 ma. films
First place was given to 6% of the 250 ma. films
First place was given to 1% of the 100 ma. films
Second place was given to 9% of the 1,000 ma. films
Second place was given to 61% of the 500 ma. films
Second place was given to 22% of the 250 ma. films
Second place was given to 8% of the 100 ma. films
Third place was given to 3% of the 1,000 ma. films
Third place was given to 23% of the 500 ma. films
Third place was given to 52% of the 250 ma. films
Third place was given to 22% of the 100 ma. films
Fourth place was given to 5% of the 1,000 ma. films
Fourth place was given to 5% of the 500 ma. films
Fourth place was given to 20% of the 250 ma. films
Fourth place was given to 70% of the 100 ma. films

A survey of these choices shows that the percentage of preferences increases as the milliamperes increase. Other figures show that 45 per cent of the films were placed in the order of the milliamperes used in the exposures.

TIME

Another subject investigated was the effect of the time of exposure on the diagnostic quality of chest roentgenograms. This was done by asking each of the visiting roentgenologists to judge and grade the second group of roentgenograms.

This group consisted of five or six chest roentgenograms made on each of 30 patients at 1/120, 1/60, 1/30, 1/20, 1/10, and 1/4 second exposure times. A motor driven top on the upper left hand corner above each patient's shoulder recorded on the film the number of impulses in each

TABLE I

CHOICES IN TIME OF EXPOSURE EXPERIMENT
EXPRESSED IN PERCENTAGES

No.	1/120	1/60	1/30	1/20	1/10	1/4	No.	1/120	1/60	1/30	1/20	1/10	1/4
1	0	0	100	0	0	0	26	0	10	30	20	40	0
2	20	0	20	60	0	0	27	0	20	40	20	20	0
3	10	30	30	20	10	0	28	0	40	20	40	0	0
4	20	10	40	20	10	0	29	0	60	0	0	20	20
5	0	0	40	40	20	0	30	0	20	60	20	0	0
6	0	0	40	20	40	0	31	0	60	40	0	0	0
7	0	10	70	10	10	0	32	0	0	60	40	0	0
8	0	10	70	10	10	0	33	0	40	0	60	0	0
9	0	10	30	10	20	30	34	0	40	40	20	0	0
10	0	30	20	30	20	0	35	20	40	40	0	0	0
11	10	10	20	0	60	0	36	0	0	20	60	20	0
12	0	0	60	20	20	0	37	0	40	40	0	20	0
13	10	20	20	40	10	0	38	0	0	0	20	80	0
14	60	0	20	0	20	0	39	0	20	40	20	20	0
15	20	20	40	0	20	0	40	0	20	60	0	20	0
16	50	10	40	0	0	0	41	0	20	20	0	60	0
17	10	20	40	10	20	0	42	0	0	60	40	0	0
18	10	0	40	20	20	0	43	0	0	40	20	40	0
19	10	10	50	10	20	0	44	0	20	60	20	0	0
20	10	0	40	20	30	0	45	0	0	60	20	20	0
21	0	0	40	50	10	0	46	0	0	60	40	0	0
22	0	0	40	50	10	0	47	0	0	0	20	80	0
23	0	20	60	20	0	0	48	0	40	20	20	20	0
24	0	40	40	20	0	0	49	0	0	60	0	40	0
25	0	0	40	50	10	0	50	0	0	40	20	40	0

Time	1/120	1/60	1/30	1/20	1/10	1/4
Totals	240	260	1,960	1,060	940	60
Percentage	5	15	39	21	19	1

fractional second exposure. This left no doubt as to what exposure time was used, but this record of the exposure time was kept out of sight during the study of the films.

The roentgenologists graded five to thirty sets of these roentgenograms. This they did by judging the value of each film diagnostically. They saw no technical data on any film, but they knew the exposure times varied from 1/120 or 1/60 to 1/4 second, that densities were kept as comparable as possible and that the target-film distance was the same throughout. After choosing the best diagnostic film, they were asked to arrange the films in the order of their exposure times basing their judgment upon evidence of motion.

Table 1 shows their choices.

These choices illustrate the diagnostic value of short times of exposure but they present no conclusive data as to how short the exposure must be to depict the least evidence of motion. For the present it may be stated that in the opinion of fifty roentgenologists the exposure time of chest roentgenograms should be 1/20 second or less.

DISTANCE

To learn of the influence of target-film distance in improving the diagnostic quality of chest roentgenograms, over one hundred films were exposed of different individuals at distances of from 3 to 12 feet. In making the exposures density, contrast, and time were kept as uniform as possible.

For this series, the milliamperage was changed to compensate for the variation

TABLE II

CHOICES IN THE TARGET-FILM DISTANCE EXPERIMENT EXPRESSED IN PERCENTAGES

No.	9′	8′	7′	6′	5′	No.	9′	8′	7′	6′	5′
1	80	20	0	0	0	26	0	20	20	40	0
2	20	20	40	20	0	27	40	0	40	20	0
3	10	50	40	0	0	28	60	0	20	20	0
4	40	30	30	0	0	29	60	20	20	0	0
5	0	60	0	20	20	30	20	40	40	0	0
6	0	40	40	20	0	31	20	20	60	0	0
7	0	0	50	30	20	32	0	40	20	40	0
8	0	0	50	30	20	33	20	40	20	20	0
9	0	0	50	30	20	34	20	40	20	20	0
10	0	30	20	50	0	35	0	40	20	40	0
11	10	20	30	30	10	36	40	40	20	0	0
12	0	40	40	20	0	37	0	100	0	0	0
13	0	20	30	30	20	38	0	40	40	20	0
14	100	0	0	0	0	39	20	20	40	20	0
15	30	30	40	0	0	40	20	40	20	20	0
16	90	10	0	0	0	41	0	60	40	0	0
17	10	60	20	10	0	42	0	20	20	60	0
18	0	30	0	40	30	43	0	20	20	20	40
19	0	20	40	40	0	44	0	60	40	0	0
20	10	60	20	10	0	45	0	0	60	40	0
21	0	20	50	30	0	46	0	20	60	20	0
22	40	50	10	0	0	47	20	0	20	40	20
23	40	20	40	0	0	48	0	40	40	20	0
24	0	20	80	0	0	49	10	40	20	20	0
25	20	0	40	40	0	50	20	20	40	20	0

Distance	9′	8′	7′	6′	5′
Totals	870	1,430	1,470	950	200
Percentages	18	29	30	19	4

in distance—the penetration and time of exposure remaining constant.

The roentgenologists graded five to thirty sets of these films. They did not consider those taken at 3, 4, 10 and 12 feet. They saw no technical exposure data during the grading. They knew that the target-film distance of the five of each patient varied from 5 to 9 feet, that they were to select the roentgenogram of each patient giving the most useful information from a diagnostic standpoint and that they were to try to arrange the films of each patient in proper order basing their judgment on sharpness of detail, a function of distance.

Their choices as reflected in Table II show that they saw a higher diagnostic quality in films taken at 7 and 8 feet (59 per cent), and the least diagnostic value in those at 5 feet; that they had considerable difficulty in differentiating between films taken at 7, 8, and 9 feet, and finally that to some of them a decrease or increase in target-film distance of 1 foot produces perceptible changes in sharpness of detail.

DENSITY

Density presented a more difficult problem. The degree of general lightness or darkness or density preferred by roentgenologists varies within wide limits. Yet the density of a chest film can be too dark or too light. Both extreme density and lack of density handicap diagnosis by diminishing the visibility of detail and, if too extreme, by blotting out all detail.

The problem of determining the appropriate density was met by making two series of eight roentgenograms each on the same patient, one series with 100 milliamperes at 6 foot target-film distance in 1/10 second with density varying about 100 per cent in gradations of about 12.5 per cent and the other series of eight with 1,000 milliamperes at 7 foot distance, in 1/30 second with density varying about 80 per cent in gradations of about 10 per cent.

The roentgenologists individually and separately selected from each series of eight the exposure that in their opinion provided the most useful information from a diagnostic angle. They also indicated what films in each series they thought too light or too dark. Their choices were as follows:

TABLE III

CHOICES IN THE DENSITY EXPERIMENT

1000 ma.	100 ma.	1000 ma.	100 ma.
65	78	75	85
67	78	65	75
72	85	70	76
70	85	70	82
70	78	65	78
67	85	67	87
67	80	72	82
67	80	70	78
70	82	70	85
72	80	67	80
62	78	65	80
67	80	70	80
67	80	72	87
70	80	67	80
67	85	67	78
65	80	65	78
67	82	72	80
67	78	70	85
62	78	65	72
65	82	67	78
75	85	70	80
65	80	65	80
72	85	75	87
67	80	65	78
67	82	65	78
Milliamperes	1,000	100	
Totals	3,403	4,045	
Kilovoltage	68	80	

The numbers represent the kilovoltage peak used in making what each roentgenologist considered as the best film diagnostically.

The films discarded by the group as unsatisfactory because of too little or too much density, when analyzed, showed that there is an allowable density variation of approximately 50 per cent, which means that for an average exposure of the whole chest there are four or five densities that are satisfactory and difficult to differentiate in quality.

CONCLUSIONS

The choices of fifty representative roentgenologists indicate that chest roentgeno-

grams taken with higher power factors have a diagnostic superiority over those taken with low power factors. These choices specifically indicate that:

1. Contrast produced by the lower voltages made possible through the use of 1,000 milliamperes helps make a better diagnostic film than the degree of contrast resulting at 500, 250, and 100 ma. with the increase in kilovoltage peak necessary to maintain the desired density at these current values.

2. Chest films taken in less than 1/10 or 1/20 second are better diagnostically than those with longer exposure times.

3. Target-film distance has a distinct fluence on sharpness of detail, films exposed at 7 or 8 foot distance ranking highest.

4. On a single patient there are four or five exposures with different densities that are satisfactory to the majority of roentgenologists. However, it is possible to lose valuable detail by too much or too little density.

THE AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY

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American Congress of Radiology†*

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Headquarters of the Executive Council: 2561 North Clark St., Chicago, Ill.

For Preliminary Program of American Congress of Radiology: See April Number, AMERICAN JOURNAL OF ROENTGENOLOGY AND RADIUM THERAPY, page 539.

Date of Meeting: September 25–30, 1933.

Place of Meeting: Palmer House, Chicago Ill., Scientific Sessions, Scientific and Commercial Exhibits will all be held in this Hotel.

* For Officers and Standing Committees of the American Roentgen Ray Society and the American Radium Society usually carried on this page, see the April, 1933, number of the Journal.

† Combined meeting of: American Roentgen Ray Society, American Radium Society, American College of Radiology, Radiological Society of North America.

EDITORIALS

EFFICIENCY AND ECONOMY APPLIED TO THE ROENTGEN DEPARTMENT

IN ANY solution of the hospital problem means of promoting hospital efficiency and economy must not be at the sacrifice of ethical and fair consideration of the private practice of roentgenology. The hospital's economic scheme should not lean toward decreasing the fair and rightful profits of the physician. The loyal application of specialty training and consultation ability demands for its continuation a like loyalty from the hospital.

No beam of depression, economy or possible profit should obscure the vision of worthy service throughout years of an active professional life. Many of the attempts by hospital authorities to minimize, standardize, salaryize and level medical fees are serving to promote an unhealthy approach to the socialization of medicine which is inimical to productive individuality.

Many of the compromises of hospitalization schemes with the ethical and individualistic practice of medicine serve to detract from the reasonable rewards to physicians for loyalty, for studious application to professional attainment and may serve to segregate the time-honored teamwork of hospital and physicians.

The attitude of many hospital executives to look upon various medical activities as supplemental laboratory service or supplemental therapy or supplemental examinations rather than the actual practice of medicine will serve to estrange physicians practicing such specialties.

Far worse in the ultimate dangers of such conceptions of laboratory and mechanical measures is the fact that such interpretation of medical practice will serve to divert medical students to other channels of practice, and devitalize, perhaps even kill and destroy, the progress and qualified application of otherwise attractive specialized departments of medicine.

Such conceptions of hospitalization progress and medical practice cannot continue parallel forever. The hospital cannot absorb functions of medical practice and escape the censure of time.

There must be compensation for studious application and a charm to the ultimate goal; otherwise, medical bench-sitters and switch-pullers will become mere automatons or human robots. Nay, it would not be a distant development to add other minor medical specialties to this automatic, colorless, efficient, freedomless and mechanical scheme of the hospital organization.

It should be remembered that physicians preceded hospitals; that physicians can practice without hospitals but that hospitals cannot operate without physicians. The modern hospital executive with his experience and business ability should have a more sympathetic appreciation of the physician's problems. Business and professional effort can make a fine suspension but they rarely make a true solution of any problem.

No short-sighted approach to the economic demands of the present time should be allowed to prevail. There should be and there are methods of approach to the problem, and these proposed solutions are applicable in days of plenty as well as in these lean years. My proposals do not interfere with individual ambition and they serve to promote hospital economy and profit.

Salaries should not be given for professional effort; rather should there be a per-

centage basis of compensation and a sharing of proceeds. The former destroy ambition, while commission payment stimulates effort, promotes saving, provides for future progress, and advancement of happiness.

A hospital cannot hire physicians and escape the responsibility and accusation of pursuing medical practice. Hospitals cannot profit from the laboratory and other practice of physicians on a percentage basis and not be a party to a system of fee-splitting.

In many localities there are several hospitals, none of which may offer sufficient within their own walls to attract or pay for the full-time consultative service of a roentgenologist. With technical demands satisfied by a full-time technician, one roentgenologist may easily care for the diagnostic demands of at least four hospitals each day. Modern roads and rapid transportation make fifty mile trips as easy as any twenty-five blocks in street car days.

Technical service is easily established and economic possibilities are many. There is no reason why the technician in small hospitals could not easily serve both the roentgenologic and pathologic laboratories. Bookkeepers, record clerks and operating room nurses can easily become roentgen-ray technicians without sacrifice to either service.

Space-planning economies are many, and I believe that all laboratories and operating rooms should be compactly arranged on the same floor and in the same wing. This would aid in the cooperation of technical assistants, avoid many steps by many people, concentrate the staff in this working unit, develop contacts and increase the demands for laboratory examinations, and promote more consultation between attending physicians and laboratory consultants.

The cystoscopic room can be next door to the roentgen department and be served by a single roentgen-ray transformer. The fracture room can be next door and equipped with a fluoroscopic fracture unit. The combined plate-viewing room and roentgenologist's office should be near the pathologist's office to afford that cooperative consultative service so beneficial to attending physician, surgeon and patient.

Economies in roentgen fees can be effected by securing the cooperation of the staff in asking for roentgenologic consultation for the particular diagnostic problem rather than a blanket demand for extensive and expensive technical procedures.

As to the nature of the request slips which come to the roentgenologist with cases, the clinicians could easily be induced to make more specific requests upon the clinical problem. One such case came with the legend, "Query, Chest"; the answer was returned, "Chest present, but feeble!"

Economies by cutting down the number and size of plates are rarely sane economies. The percentage saved is minimal and the loss to the patient may be great. Undoubtedly roentgenoscopic examinations by a roentgenologist can save many technical expenses. The cooperative roentgenoscopic consultation of clinician and roentgenologist can result in great saving and afford increased value to the patient and add to the hospital's reputation. Roentgenoscopic examinations are warranted in acute and chronic fluid and mass lesions of the chest and many gastrointestinal lesions affecting mobility and motility and gross filling defects. Stereoscopy should be carried out only when necessary.

Large films are expensive and their use can be reduced by intelligent cooperation of clinician and roentgenologist. Do not insist upon selling the patient roentgen films and disregard the advantages of thoughtful roentgen interpretation and intelligent, experienced roentgenoscopy.

Responsibility establishes worth and demands compensatory recompense. Service requires payment for basic expenses and sufficient pecuniary reward to compensate for intelligent direction, regular daily consultation service, satisfactory hospital records and reports, continuity of loyal serv-

ice and reward for ambitious extension and enlargement of that service to attending physician and patient.

However, economies must not be pursued which embarrass professional interest and activity. It should be remembered that 85 per cent of medical practice can be successfully pursued by intelligent clinicians without laboratory, hospital, mechanical or modern methods. Common sense can easily eliminate much high-powered medicine but this is a rare mental commodity.

Modern mechanical medicine has replaced much medieval magic but the human mind can easily return to the charm of magic and mystery.

E. H. Skinner

ROLAND E. LOUCKS

1869 - 1933

THE medical profession, particularly those engaged exclusively in roentgenology and radiotherapy, has lost a valuable and honored member in the death of Dr. Roland E. Loucks of Detroit who died at his home on June 8, 1933. Dr.

Loucks had been ill for about two years with cardiorenal disease but with the exception of about five or six months he had been able to carry on his practice. He was born at Smith's Falls, Ontario, on October 11, 1869. He was educated in the high school of his native province, after which he studied dentistry at the University of Maryland, from which he was graduated with the degree of D.D.S. in 1893, receiving the gold medal. He practiced dentistry for three years at Monroe, Michigan. He left Monroe to take postgraduate work in dentistry and in 1897 was awarded a dental degree by the Royal College of Dental Surgeons, Toronto, with registration in Ontario, after which he practiced in Smith's Falls, Ontario. Dr. Loucks, however, looked forward to a different professional career and accordingly began the study of medicine at Trinity and Toronto University from which he received the degree of M.D.C.M. in 1903. He located in Detroit the same year devoting his time to general practice.

In 1914 he began to give special attention to radium therapy after a prolonged period of postgraduate study in England, France and Germany.

In 1916, with a number of other enthusiasts, he was active in founding the American Radium Society of which he was president in 1922. He made numerous contributions to the medical literature on the use of radium in the treatment of goiter and in malignant conditions. Dr. Loucks always took an active interest in medical affairs not only in his county society but also in the state, as well as in various societies devoted to his chosen specialty. During the summer of 1924 he visited a number of the larger radiological centers of Great Britain and the Continent. He was a member of the Wayne County and Michigan State Medical Societies, the American Medical Association, the American College of Radiology, the American Roentgen Ray Society, the American Radium Society, the Radiological Society of North America, Detroit Roentgen Ray and Radium Society, and the British Medical Association. He was founder and proprietor of the Memorial Hospital located in Detroit. Dr. Loucks' recreation included golf, lawn bowling and curling.

In 1898 Dr. Loucks married Miss Mary E. Dunlop. They had a son, Baden, and a daughter, Anna, who survive. Mrs. Loucks died in August, 1922. In 1926 Dr. Loucks married Mae B. Lyon who survives.

Dr. Loucks had an unusually pleasing and agreeable personality. Of distinguished appearance he was one long to be remembered as he appeared at the numerous professional assemblages. Schooled in sorrow, for the first Mrs. Loucks was for a long period an invalid and his daughter has been incapacitated for over twelve years, he had a warm feeling for all sufferers. Out of it all evolved a fine philosophy which not only sustained him but made him a close friend to all who came within his inner circle.

J. H. DEMPSTER

SOCIETY PROCEEDINGS CORRESPONDENCE AND NEWS ITEMS

Items for this section solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

American Roentgen Ray Society
Secretary, Dr. E. P. Pendergrass, University Hospital, Philadelphia, Pa.
Annual Meeting: Chicago, Ill., Sept. 25–30, 1933.

American College of Radiology
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los Angeles, Calif.
Annual meeting: Chicago, Ill., Sept. 25–30, 1933.

Section on Radiology, American Medical Association
Secretary, Dr. J. T. Murphy, 421 Michigan St., Toledo, Ohio.
Annual meeting: Milwaukee, Wis., June 12–16, 1933.

Radiological Society of North America
Secretary, Dr. D. S. Childs, 607 Medical Arts Bldg., Syracuse, N. Y.
Annual meeting: Chicago, Ill., Sept. 25–30, 1933.

Radiological Section, Los Angeles County Medical Society
Secretary, Dr. D. R. MacColl, 2826 S. Hope St., Los Angeles, Calif.
Meets on the third Wednesday of each month at the California Hospital.

Radiological Section, Southern Medical Association
Secretary, Dr. C. H. Heacock, 20 S. Dunlap St., Memphis, Tenn.
Annual meeting: Richmond, Va., November, 1933.

Brooklyn Roentgen Ray Society
Secretary, Dr. G. W. Cramp, 921 President St., Brooklyn, N. Y.
Meets monthly on first Tuesday, October to April.

Buffalo Radiological Society
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St., Buffalo, N. Y.
Meets second Monday of each month except during summer months, place of meeting selected by the host.

Chicago Roentgen Society
Secretary, Dr. George M. Landau, 660 Groveland Park.
Meeting second Thursday of each month October to May inclusive at Virginia Hotel.

Cincinnati Radiological Society
Secretary, Dr. H. G. Reineke, Christian R. Holmes Hospital, Cincinnati, Ohio. Meetings held monthly.

Cleveland Radiological Society
Secretary, Dr. M. A. Thomas, Medical Arts Bldg.
Meetings are held at 6:30 P.M. at the Cleveland Chamber of Commerce Club rooms on the fourth Monday of each month from October to April, inclusive.

Detroit Roentgen Ray and Radium Society
Secretary, Dr. E. R. Witwer, Harper Hospital.
Meets monthly on first Thursday from October to May, at Wayne Country Medical Society Building.

Florida Radiological Society
Secretary, Dr. W. McL. Shaw, 418 St. James Bldg., Jacksonville, Fla.
Meetings held twice a year, May and November.

Illinois Radiological Society
Secretary, Dr. L. M. Hilt, Myers Bldg., Springfield, Ill.
Regular meetings held quarterly.

Indiana Roentgen Society
Secretary, Dr. J. N. Collins, Indianapolis, Ind.
Annual meeting each February 22 in Indianapolis.

Michigan Association of Roentgenologists
Secretary, Dr. S. W. Donaldson, St. Joseph's Mercy Hospital, Ann Arbor, Mich. Three meetings a year, Fall, Winter, and Spring. Next meeting, Kalamazoo, Mich., October, 1933.

Milwaukee Roentgen Ray Society
Secretary, Dr. J. E. Habbe, 221 Wisconsin Ave., Milwaukee, Wis.
Meets first Friday in October, December, February and April. Place of meeting designated by the president.

Minnesota Radiological Society
Secretary, Dr. L. G. Rigler, University Hospital, Minneapolis, Minn.

New England Roentgen Ray Society
Secretary, Dr. Thomas R. Healy, 370 Marlboro St., Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

New York Roentgen Society
Secretary, Dr. C. W. Schwartz, 33 E. 68th St., New York.
Meets monthly on third Monday, New York Academy of Medicine, at 8:30 P.M.

Central New York Roentgen Ray Society
Secretary, Dr. H. S. Bull, 604 Masonic Temple, Auburn, N. Y.
Three meetings a year—January, May and November.

Pennsylvania Radiological Society
Secretary, Dr. W. E. Reiley, Clearfield, Penna.

Philadelphia Roentgen Ray Society
Secretary, Dr. Karl Kornblum, 3400 Spruce St.
Meeting first Thursday of each month from October to May inclusive, at 8:15 P.M., in Thompson Hall, College of Physicians, 19 S. 22d St.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. W. W. Fray, Strong Memorial Hospital.
Meets monthly on second Thursday from October, 1932, to May, 1933 inclusive, at 7:45 at the Rochester Medical Association Building.

St. Louis Roentgen Club
Secretary, Dr. W. K. Mueller, University Club Bldg.
Meets first week of each month. Time and place of meetings designated by president.

South Carolina X-Ray Society
Secreary, Dr. R. B. Taft, 105 Rutledge Ave., Charleston, S. C.
Meets at time and place of South Carolina State Medical Association.

Texas Radiological Society
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Meets annually one day preceding the meeting of the Texas State Medical Association.

University of Michigan Roentgen Ray Society
Secretary, Dr. C. C. Taylor, University Hospital, Ann Arbor, Mich.
Meets first and third Wednesday evening of the month from October to June, at 8 o'clock in the amphitheatre of the University Hospital.

* Secretaries of Societies not here listed are requested to send the necessary information to the Editor.

Virginia Roentgen Ray Club
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.
Meets annually in October.

Cuba

Sociedad Cubana de Radiologia y Fisioterapia
Secretary, Dr. Luis Fariñas, Animas 110, Havana, Cuba.
Meets monthly in Havana.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Meets on the third Thursday of each month, from November to June inclusive, at 8:15 p.m., at 32 Welbeck St., London, W. 1., or as advertised.

Electro-Therapeutic Section of the Royal Society of Medicine (Confined to Medical Members)
Meets on the third Friday of each month during the winter at 8:30 p.m. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

Section of Radiology and Medical Electricity, Australasian Medical Congress
Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.

Radiological Section of the Victorian Branch of the British Medical Association
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

Section on Radiology, Canadian Medical Association
Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

Indian Radiological Association
Secretary, Sd. Subodh Mitra, 148 Russa Rd., Calcutta.
Meets annually in January, and at such places and times as the Council may appoint.

Radiological Section, New Zealand British Medical Association
Secretary, Dr. P. C. Fenwick, The Hospital, Christchurch. Meets annually.

Continental Europe

Belgian Society of Roentgenology
Secretary, Dr. J. Boine, Avenue des Allies, 134, Louvain, (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summer time.

Société de Radiologie Médicale de France
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

Société Suisse de Radiologie (Schweizerische Röntgen-Gesellschaft)
Secretary for French language, Dr. A. Grosjean, La Chaux de Fonds.
Secretary for German language, Dr. Scheurer, Molzgasse, Biel.
Meets annually in different cities.

Société Francaise d'Electrothérapie et de Radiologie Médicale
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

Association of German Roentgenologists and Radiologists in Czecho-Slovakia
Secretary, Dr. Walter Altschul, German University, Prague, 11/52.

Deutsche Röntgen-Gesellschaft (Gesellschaft für Röntgenkunde und Strahlenforschung)
Meets annually in April in different German cities, at least once in five years in Berlin. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

Dutch Society of Electrology and Roentgenology
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

Societa Italiana Radiologia Medica
Secretary, Professor M. Ponzio, University of Turin, Turin.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banul Maracine 30 Bucarest, Rumania.
Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad, USSR, in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson.
Meets annually.

Leningrad Roentgen Ray Society
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly, first Monday at 8 o'clock, State Institute of Roentgenology and Radiology, Leningrad.

Moscow Roentgen Ray Society.
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

Polish Society of Radiology
Secretary, Dr. Jan. Kochanowksi, 45 Gornoslazka St., Warsaw. Meets annually.

Warsaw Section, Polish Society of Radiology
Secretary, Dr. B. Krynski, 11 Zielna St.
Meets once a month except in the summer time.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with exception of the Denmark Society, meets every second month except in the summer time.

Society of Medical Radiology of Sweden
Meets in Stockholm.

Society of Medical Radiology in Norway
Meets in Oslo.

Society of Medical Radiology in Denmark
Secretary, Dr. H. Scheuermann, Copenhagen.
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institue of Roentgenology.

Society of Medical Radiology in Finland
Meets in Helsingfors.

Vienna Society of Roentgenology
Meets first Tuesday each month, October to July.

Orient

Japan X-ray Association
c/o Orthopedic Surgery, Tokyo Imperial University.
Meets annually in April.

Kinki Roentgen-Abend Society
Director, Dr. Prof. Taiga Saito, Ogawaoike, Kyoto, Japan. Meets bi-monthly on third Sunday.

MINNESOTA RADIOLOGICAL SOCIETY

The annual meeting of the Minnesota Radiological Society was held in Rochester, Minnesota, May 22, 1933, in conjunction with the annual meeting of the Minnesota State Medical Association. The following program was presented:

Radiation Therapy in Non-malignant Conditions. Gage Clement, Duluth. Discussed by Wilhelm Stenstrom, Minneapolis.

Correlative Value of Clinical and Pathological Findings in Roentgenological Diagnosis. Kano Ikeda, St. Paul. Discussed by Charles G. Sutherland, Rochester.

The Place of the Roentgenologist in the Private Practice of Medicine. Leo G. Rigler, Minneapolis. Discussed by E. L. Tuohy, Duluth.

Childhood Tuberculosis. R. G. Allison, Minneapolis. Discussed by C. A. Stewart, Minneapolis.

Round Table Conference: Roentgen Diagnostic Problems. Conducted by B. R. Kirklin, Rochester.

The following officers were elected for the coming year: President: Edward Schons, St. Paul; Vice-President: R. G. Allison, Minneapolis; Secretary-Treasurer: L. G. Rigler, Minneapolis.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers as space permits.

A TEXTBOOK OF SURGERY. By John Homans, M.D., Assistant Professor of Surgery, Harvard Medical School. Second edition. Price, $8.00. Pp. 1231, with 517 illustrations. With a special bibliographical index and with illustrations by Willard C. Shepard. Springfield, Illinois: Charles C Thomas, 1932.

The early need of a second edition of this textbook indicates that it has found popularity with the student of surgery. Minor changes have been made throughout the book in the interest of clarity and accuracy. A new chapter on anesthesia has been added in which the historical and physiological aspects of this subject are simply and clearly presented. All modern methods of anesthesia are considered in sufficient detail to have a practical value to the surgeon and are certainly ample for the needs of the medical student. New material has been interpolated and added to many chapters without change in the pagination, a matter of interest to teachers who have used the first edition.

The recent developments in the knowledge of the endocrine system, of interest to surgeons, have been adequately presented in this new edition. Hyperparathyroidism and its relation to skeletal disorders, hyperinsulinism due to adenomas of the pancreas, and Cushing's basophilism, are discussed briefly but at sufficient length for the medical student.

Two years' use of the first edition as a textbook for medical students has served to confirm and amplify the original favorable impression. The intimate informality of the style, the charm of the historical backgrounds and the vigor of presentation, grow upon one with continued use of the book. The second edition is an improvement in the omission of occasional errors, in the presentation of new material, and in rearrangement of certain obscurities. This edition, like the first, is highly recommended to any student of medicine and to any practitioner or surgeon who wishes to read with pleasure a concise presentation of modern surgical knowledge.

FREDERICK A. COLLER

PEPTIC ULCER. By Jacob Buckstein, M.D., Instructor in Gastrointestinal Roentgenology, Cornell University Medical College (Annals of Roentgenology, Volume X.) Second edition, revised. Cloth. Price, $12.00. Pp. 417, with 405 illustrations. New York: Paul B. Hoeber, Inc., 1933.

Objectives of this monograph, now newly revised, are set forth in prefaces respectively by the editor, the author and Dr. Santee. In sum it is designed to present a textual and pictorial roentgenologic survey of peptic ulcer, not merely in the interest of the roentgenologist but also that of the gastroenterologist, the internist and the surgeon. Considered from these diverse, though associated standpoints, with appreciation of the fact that it is impossible to convey complete understanding of the subject by printed word and illustration, the book fulfills its purposes. Illustrations preponderate so largely over text that the work constitutes an atlas, and thus conforms to the editor's plan for a series of monographic atlases of which this is one. Necessarily, then, the descriptive matter is sketchy and elementary. Even so, it covers the basic facts relating to the roentgenology of peptic ulcer—gastric, duodenal, gastrojejunal.

In the introductory chapter dealing with the history of the application of roentgen rays to the diagnosis of gastrointestinal disease, it is especially pleasing to note that the pioneer researches of Williams and Cannon and Hemmeter are accorded the place of honor. Likewise, the great contribution of Cole to the diagnosis of duodenal ulcer is given due recognition. These are timely reminders that in developing the roentgenology of the alimentary canal Americans have given a full share of effort and accomplishment.

Three-fourths of the book is devoted to case histories with positive prints of the respective roentgenograms. Most of the latter depict gross lesions, in situations where they are usually conspicuous, and of a type easy to illustrate. Thus it would be unfortunate if this work were regarded as confirming a too prevalent opinion among internists that the roentgenologic diag-

nosis is essentially pictorial and quite simple. But if properly used the volume should help students, clinicians, gastroenterologists and surgeons to understand the problems of the roentgenologist and should promote more effective cooperation of all those concerned with the discovery, identification and treatment of peptic ulcer.

B. R. Kirklin

Les kystes hydatique intrathoraciques centraux et pariétaux; chirurgie; radiologie. Par R.-G. Brun, Ancien interne des Hôpitaux de Paris, Correspondent National de la Société de Chirurgie de Paris, Chirurgien Chef de l'Hôpital Sadiki de Tunis, et A. Jaubert de Beaujeu, Chef du Service Radiologique de l'Hôpital Sadiki et de l'Hôpital Civil Français de Tunis. Pp. 9, with 42 illustrations. Paris: Norbert Maloine, 1933.

Hydatid cyst of the lung is a rare condition to most roentgenologists but such is not the case with the authors, who see on an average of one patient with echinococcus infection every week. Approximately 80 per cent of the cysts occur in the liver but the remaining 20 per cent furnish the material for a relatively large experience in pulmonary cysts. Twenty-four cases are presented, including four with cysts in both lungs. The cases are illustrated by plates of good quality including both posteroanterior and lateral projections.

Both the diagnostic aspects and the surgical treatment are considered. Points of differentiation from infections of the abscess type and from neoplasms are discussed. The relative incidence of cysts as compared with neoplasm may be judged from the fact that the authors' experience of the past ten years in Tunis includes only two pulmonary sarcomas.

The authors differ with other writers as to the character of the shadow of hydatid cysts, those of their series presenting more sharp and smoothly curved borders than have been described by Belot and Peutenil.

This well-written monograph is both interesting and instructive.

E. Walter Hall

The Physiological Effects of Radiant Energy. By Henry Laurens, Ph.D., Professor of Physiology in the Tulane University School of Medicine, New Orleans, La. American Chemical Society Monograph Series. Cloth. Price, $6.00. Pp. 610, with 104 illustrations. New York: Chemical Catalog Company, 1933.

Many books on ultraviolet rays have been written, most of them being relatively limited in scope and their object being chiefly to set forth in simple manner the essential facts concerning ultraviolet and infra red rays for physicians who have little knowledge of radiant energy in general and who are not familiar with the physical aspects of the subject. Few books of outstanding merit have heretofore been published. Moreover, the literature has been crowded with statements, many of which rest on rather flimsy evidence.

Doctor Laurens' book comes to fill an important need by supplying rather complete information about the physiologic effects of radiant energy. It constitutes an elaborate and painstaking summary of all the experimental and clinical observations relating to ultraviolet and infra red rays and as such is extremely valuable. Its value may not be appreciated by the general practitioner who does not have time for extended reading, but it will be appreciated by every physician who really desires to inform himself concerning the effects of radiant energy on the body and how these effects are produced, as far as such information is available at the present time.

The book is divided into seventeen chapters, the first being a general introduction. The other chapters take up the physics of radiant energy, the effects on the skin, the effects on wounds and skin diseases, the effects on the eye, on the circulatory system, on the blood, on metabolism, on body temperature, respiration and blood reaction, on tuberculosis, on bacteria, toxins, antitoxins, proteins, ferments, on photodynamic or optical sensitization, and the mode of action on physiological and pathological processes. The book will be invaluable to the specialist and to all others as a mine of information which heretofore has been scattered and therefore often not accessible. In the opinion of the reviewer this is the most valuable book on ultraviolet and infra red rays which has yet appeared.

A. U. Desjardins

La technique de la curiethérapie. (The technique of curie therapy.) Par Simone Laborde, Chef du service de Curiethérapie a l'Institut du Cancer. Paper. Price, 20 fr. Pp. 118, with 12 illustrations. Paris: Gauthier-Villars et Cie, 1933.

This is one of a series of monographs published under the editorship of Duhem (Paris) dealing with those physical agents used in human therapy.

The author devotes the introduction to radiobiology presenting briefly the fundamental principles on which our modern cancer therapy is based. The applicators for beta and gamma irradiation are then described, followed by a discussion of the various techniques developed for their most effective use. Space is also given to the physics of dosimetry and the reader finds data and practical examples showing the calculation of the treatment time for certain screens and filters. A few minor errors may be detected here by the careful reader. In an appendix is found a number of tables, mostly giving physical constants of radioactive substances. The author, who is well known to radiologists attending the international congresses, has condensed a great deal of valuable information into small space.

Ernst A. Pohle

Books Received

Intracranial Tumors. By Percival Bailey, Professor of Surgery, University of Chicago. Cloth. Price, $6.00. Pp. 475, with 155 illustrations. Springfield, Illinois; Baltimore, Maryland: Charles C Thomas, 1933.

Peptic Ulcer. By Jacob Buckstein, M.D. (Annals of Roentgenology, Volume X.) Second edition revised. Cloth. Price, $12.00. Pp. 417, with 405 illustrations. New York: Paul B. Hoeber, Inc., 1933.

Roentgenographic Studies of the Urinary System. By William E. Lower, M.D., F.A.C.S., Chief of Department of Urology, Cleveland Clinic, Former Associate Professor of Genitourinary Surgery, Western Reserve University, Surgeon to Cleveland Clinic Hospital, and Bernard H. Nichols, M.D., F.A.C.R., Chief of Department of Roentgenology, Cleveland Clinic, Cleveland, Ohio. Cloth. Price, $16.00. Pp. 812, with 812 illustrations. St. Louis: The C. V. Mosby Company, 1933.

Recent Advances in Radium. By W. Roy Ward, M.B., B.S., M.R.C.S., Medical Director and Surgeon to the Radium Institute, London, and A. J. Burden Smith, M.B., B.S., M.R.C.S., Surgeon to the Radium Institute, London. Cloth. Price, $5.00. Pp. 324, with 4 colored plates and 140 black and white illustrations. Philadelphia: P. Blakiston's Son & Co., Inc., 1933.

Human Cancer: Etiological Factors; Precancerous Lesions; Growth; Spread; Symptoms; Diagnosis; Prognosis; Principles of Treatment. By Arthur Purdy Stout, M.D., Associate Professor of Surgery, College of Physicians and Surgeons, Columbia University; Attending Surgical Pathologist, Presbyterian Hospital, New York. Cloth. Price, $10.00. Pp. 1007, with 331 illustrations. Philadelphia: Lea & Febiger, 1932.

The Physiological Effects of Radiant Energy. By Henry Laurens, Ph.D., Professor of Physiology in the Tulane University School of Medicine, New Orleans, La. American Chemical Society Monograph Series. Cloth. Price, $6.00. Pp. 610, with 104 illustrations. New York: Chemical Catalog Company, 1933.

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DEPARTMENT OF TECHNIQUE

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A NEW METHOD OF ROENTGEN PELVIMETRY*

PRELIMINARY REPORT

By HOWARD C. MOLOY, M.D., M.Sc.
NEW YORK CITY

IN THIS preliminary report, an optical principle is reviewed and its practical application in the form of a workable apparatus for accurate measurement of the pelvis is described. The justification for suggesting a new method of roentgen pelvimetry is the belief that its simplicity may tend to aid in popularizing a refinement in obstetrical diagnosis of undoubted importance.

The possibility of measuring the image of a pelvis in space under stereoscopic vision suggested itself during the routine examination of roentgen films as part of an experimental study of the anatomical variations in the female pelvis. This work is still in progress at the Sloane Hospital for Women, and the Roentgen-Ray Department of the Presbyterian Hospital. It is being continued along the lines described in a preliminary report, in conjunction with Dr. W. E. Caldwell.[3] We found that useful information, of greater importance than actual measurements, is gained by a study of the pelvis under stereoscopic vision. In many cases measurements are not essential, as one learns to judge ampleness in size and shape from examination of many stereoroentgenograms. But when measurements in whole, or in part, are desired, it was thought that it would be advantageous if the observer were equipped with a possible means of measuring the image in space while studying the architecture of the pelvis itself.

On further consideration it seemed logical that, under proper conditions, the image could be viewed in its true relation to the original object, particularly in reference to size and shape. A review of the literature showed that this physical principle has been noted but apparently it is by no means well known by roentgenologists generally.

Wilsey[5] very briefly and concisely describes this relationship. He states: "The stereoscopic image, obtained from stereoradiographs exposed and viewed under the proper conditions, is entirely free from distortion. The correct stereoscopic procedure re-constructs in space the radiographic representation of the subject in its true size and proportions" (Fig. 1). Further, Beck and Smith,[2] in their article on "The Physiology of a True Optical View by means of the Stereoscopic Radiograph," note that in the stereoscopic image all distortions can be corrected and a "true optical view" obtained. On this basis a new instrument has been devised whereby the size of an unknown object can be ascertained by measurement of the true optical image of the object under stereoscopic vision.

The application of this physical principle in the form of an instrument necessitates certain changes in the method of taking stereoroentgenograms. Concerning the stereoscope itself slight changes are necessary in the viewing boxes and in the optical system. The image is measured directly in space under stereoscopic vision by the use of movable armatures equipped with points which can be placed on any bony or object prominence.

The working of the instrument and the manner in which all conditions are satisfied

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for reproducing an image the same size and shape as the original object, can be illustrated by describing the primary adjustments necessary to fulfill these requirements. When these have been satisfied absolutely no adjustments of viewing box or mirror stand are necessary for viewing and measuring succeeding routine films.

In this study a 2½ inch target shift with a 25 inch tube distance, as recommended by Snook,[6] has been used. A metal bar containing a perforation near either end is routinely placed on the cassette. This marker is somewhat similar to the one described by Johnson.[4] Care is exercised in placing the mid part of the bar opposite the geometric center of the film and along the film edge (Fig. 2). Theoretically this bar may be placed on any part of the cassette. However, by fixing the marker in a central position along the film edge several advantages result. It cannot be dislodged during the technical procedure of exposure; it does not conflict with the shadow image; its position can be readily duplicated on the viewing box in geometrical alinement with the optical system of the stereoscope. The object to be measured is now placed on the roentgen table in any desired position, with or without a Potter-Bucky diaphragm, and the two exposures made.

In order to view the films correctly the stereoscope is modified. Each viewing box is fitted with two shallow pegs near the table border to correspond in size and position with the shadows of the perforations in the metal bar. These pegs are placed in the same relation to the geometric center of the viewing box as the metal bar is placed in relation to the cassette. The shadow points of the perforations in the metal bar are now punched out and the films are placed on the pegs in the viewing boxes. By these adjustments the films are assured a position in the viewing system of the stereoscope similar to the conditions under which they were exposed.

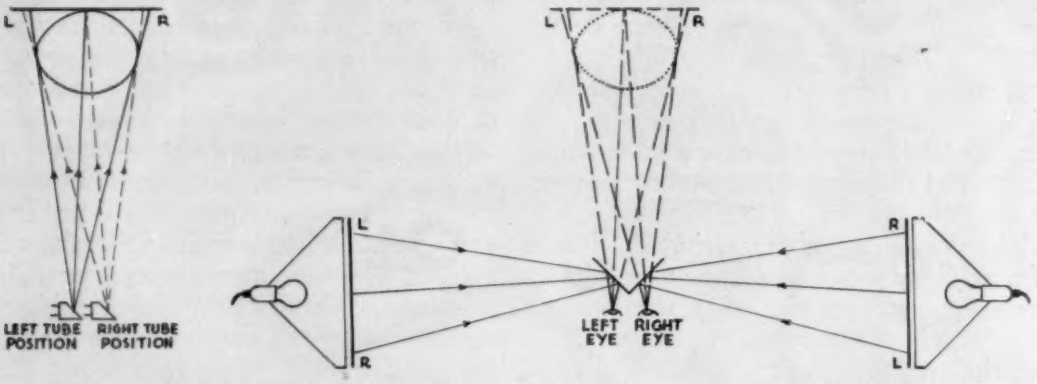

Fig. 1. "*Left*—Correct tube position for exposing stereofilms. *Right*—Correct method of viewing stereoradiographs in the Wheatstone stereoscope. Note the exact geometric correspondence between the conditions of exposing the films and the conditions of viewing the radiographs." (Wilsey.[5])

In order to permit the observer to view the armature tips and the image simultaneously, the silver mirror of the ordinary stereoscope is replaced by two pieces of plane glass or a system of prisms. The latter does away with the double image effect. The mirror stand is placed midway between the viewing boxes, the distance depending upon the original target film distance.

With the films in position it will be noted that a stereoscopic image of the object can be obtained by two maneuvers. With the mirror stand fixed, changing the angle of the mirrors to each other slowly superimposes the magnified shadow image until the third dimension is appreciated by the eye of the observer. Precisely the same effect can be obtained by fixing the mirrors at an

angle of 90° and moving the mirror support forward or backward. The second procedure is more desirable.

It is now necessary to fix the optical system of the stereoscope in alinement with the films in the viewing boxes. Difficulty is encountered in finding the proper point where stereoscopic vision occurs. The eyes tween two points on the image corresponds with the distance between similar points on the known object. The optical system is anchored at this point. All succeeding films are viewed without a single adjustment of the instrument other than manipulation of the movable armatures in the actual measurement (Fig. 2).

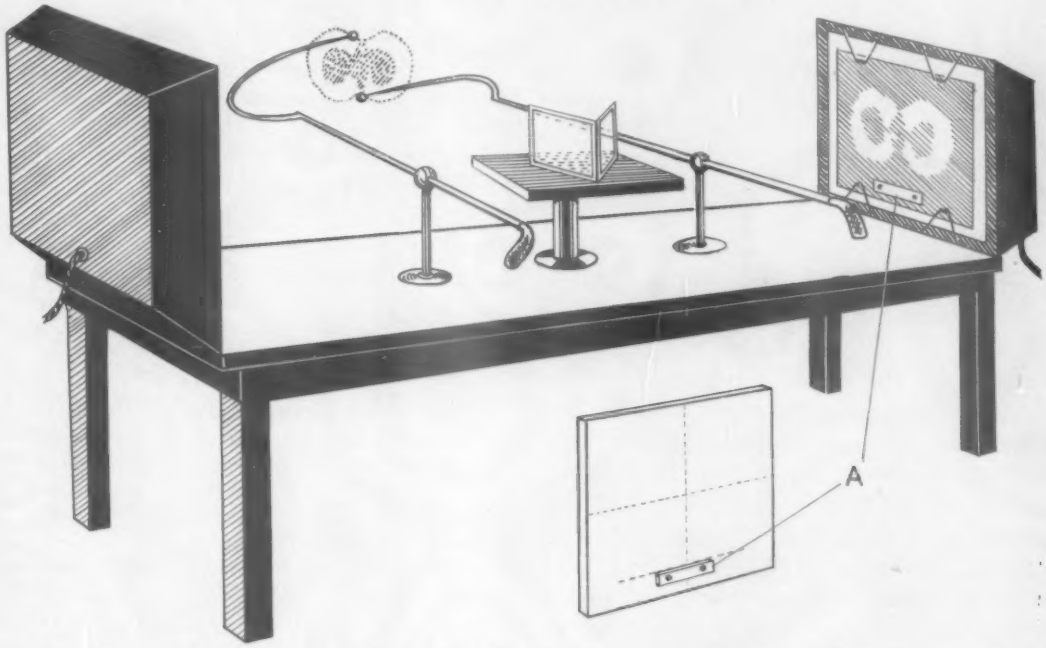

Fig. 2. Diagrammatic representation of the modified stereoscope. Note the fixed optical system of plane mirrors or prisms and the movable armatures for direct measurement of the image in space. Note, *A*, the relationship of the metal marker on the cassette to its shadow image in the roentgenogram on the pegs in the viewing box.

are not dependable as there is a natural tendency to create an apparent stereoscopic image before the roentgenograms are correctly superimposed. This difficulty is overcome by a trial and error method. Stereoroentgenograms of a known object, as for instance a dried pelvis, are made using the technique of exposure just described. The shadow points of the perforations in the metal marker are punched out and the films placed on the pegs in the viewing boxes. The mirror stand is moved slowly forward or backward. The correct superimposition of the shadow image and necessarily the precise point of stereoscopic vision exists when the measured distance be-

If the conditions under which the original object was viewed by the target of the roentgen tube have been carefully duplicated in the stereoscope, the image represents a true optical view of the object. Determination of the distance between any two points in the image is made by placing the tips of the movable armatures on the points as they appear in space behind the mirror; the distance between the armature tips is measured directly by a ruler. Under stereoscopic vision the image may be likened to a frosted glass model of the original object. It may be considered optically difficult to measure such a structure by the use of pointers viewed as "real" objects through

the plane glass mirror or prism. Actual experience shows this is by no means a formidable difficulty. However, in order to decrease the contrast the armatures are designed to appear to the eye as having the same delicate texture as the image itself.

The effect of slight variations in individual interpupillary distances on the size of the image must be considered. This possibility appears to be of sufficient importance to warrant careful experimentation since accuracy, so far as measurements go, is desired. It seems highly probable that, if such variations affect the image size, compensatory adjustments of the apparatus can be made.

By means of an apparatus arranged as described above, accurate measurements can be obtained from dried pelves. The most difficult anatomical landmark to identify on the image is the sacral promontory. This point, as a rule, is more easily appreciated on the image from a living subject than from the dried pelvis, as a result of the varying densities of the surrounding tissues in the former. Therefore, equally accurate measurements can be obtained from living subjects but to date there have been few opportunities for checking such measurements.

Recently information concerning a new roentgen-ray stereoscope based on the sound physical principles described by Kurtz and Bridge[5] has been obtained. This instrument is very similar to the modification described above except that the tube shift distance is dependent on the following formula: The shift equals the target-film distance divided by 9. "The viewing boxes move along ways inclined to the axis of the instrument on the horizontal plane, thus supplying the angle of the convergence necessary for natural vision."[1] Stereoscopic vision is automatic as the optical system is fixed in relation to the geometric center of the viewing boxes.

There is, therefore, a great similarity between the instrument devised by Kurtz and Bridge and the apparatus here described. It is hoped that further investigation, using a combination of the methods discussed, may result in the development of a practical instrument equipped with armatures whereby measurements of a bony structure can be computed directly under stereoscopic vision.

Obviously with this method the position of the patient is of secondary importance. In the early months of pregnancy the semi-recumbent position of Thoms[7] may be used. Later when the enlarged uterus tends to obscure bone detail the comfortable supine position is more advantageous. The usual care in placing the films in the viewing boxes in order to avoid pseudo-stereoscopic images must be exercised.

If time and experience prove the efficiency and practical usefulness of this instrument in roentgen pelvimetry undoubtedly it may be used to advantage wherever stereoscopic studies of a part are indicated.

Detailed results will be published later.

I wish to express my deep appreciation to Professor B. P. Watson, Director of Sloane Hospital for Women, for his interest and help throughout this work. This and further studies have been made, and are being continued in association with Dr. W. E. Caldwell, Assistant Director of Sloane Hospital for Women, and Dr. P. S. Swenson of the Roentgen-Ray Department of the Presbyterian Hospital. I am very grateful for the many valuable suggestions offered by Dr. Kenneth Cole of the Department of Physiology, Columbia University.

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Vol. XXX, No. 1

PROTECTION CLAMP FOR THE TESTIS

By ARTHUR U. DESJARDINS, M.D.
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OFTEN when irradiating a tumor affecting one testis or a tumor around the lower part of the trunk or upper part of the thigh, it is essential to protect the testis from irradiation. In many cases this can be done by the simple expedient of covering the entire scrotum with lead-rubber or metallic lead, but in certain cases, in which it may be necessary to irradiate one testis or the major portion of the scrotum, the problem is how best to protect the opposite normal gland. In our work at The Mayo Clinic, we have accomplished this for a long time by means of a sheet of metallic lead, $\frac{1}{8}$ inch thick, with rounded corners and smooth edges. This was bent over so that two edges could be brought together, leaving an expanded space within which the testis was contained and by which it was protected. Useful and effective as this arrangement has been, it was only a makeshift. A more convenient apparatus was highly desirable and, to fill this need, I had made in our own workshop the clamp illustrated (Figs. 1 and 2).

The clamp consists of two relatively shallow valves, with an opening opposite the handles large enough to allow the soft tissues forming the pedicle to pass through. In applying the instrument, the scrotal tissues over the testis to be protected are slightly stretched so as to leave as much of the scrotum as possible outside of the clamp, but with the entire testis within the

FIG. 1. Protection clamp open.

FIG. 2. Protection clamp closed and locked.

clamp and effectively protected. The valves are made of lead 1/16 inch thick, covered over with a thin layer of hard metal which has been carefully nickeled to facilitate cleaning. The essential dimensions may be noted in Figure 3. The thickness of lead specified gives practically complete protection, so that, with an ionization chamber placed within the valves, the quantity of radiation passing through the valves to reach the ionization chamber is so small that it requires considerable time to register at all.

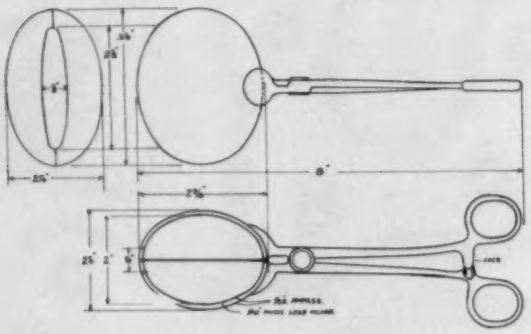

Fig. 3. Dimensions of the clamp.

This clamp could be improved further. Instead of the ordinary hemostat handles, with notched lock, handles with a threaded cross bar and thumb screw could be provided. This would permit of finer gradations of tension and should be a distinct advantage. Even better, however, would be to arrange the screw mechanism between the handles and have this work through a folding cross bar. Otherwise, the instrument serves its purpose admirably and is far superior to homemade makeshifts.

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ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

HEAD

Rogers, Lloyd, Hall, C. Taylor, and Shackelford, John H. Fractures and incomplete dislocations of the mandible or maxilla. *Radiology*, Jan., 1932, *18*, 28–40.

In 482 cases of fracture of the jaws, 94 per cent involved the mandible, the remainder the maxilla. Many fractures of the jaws are overlooked. In the authors' clinic all patients with head injuries are examined with the roentgen ray for the presence of jaw fractures. The principles employed in the treatment of fractures of the mandible and maxilla are: diagnosis from roentgenographic findings, reduction of the fracture, fixation of the parts, postoperative treatment, the use of exercising splints, and orthodontic appliances.

Removal of teeth and roots found in the line of fracture is not always advisable and, in many cases, is contraindicated. Sometimes the removal of these teeth is the cause of an osteomyelitis. Many of the retained teeth are extracted later. In gunshot fractures the removal of a foreign body is rarely warranted.

In describing the reduction of fractures, the subjects of occlusion, anesthetics, interdental wiring and postoperative care are discussed. The authors prefer the open reduction (intraoral) for fractures of the mandible in which the teeth are not present. In treating children for fractured jaws the Barton bandage is used. There is also a discussion of incomplete dislocations of the jaw.—*Ellsworth Johnson.*

NECK AND CHEST

Kwiet, Bernhard. Die Änderung der Schattentiefe des Lungen-Röntgenbildes bei der Atmung. (The change of the shadow depth of the lung roentgen picture in respiration.) *Fortschr. a d. Geb. d. Röntgenstrahlen*, Jan., 1932, *45*, 9–22.

Köhler, in 1907, introduced a procedure for the roentgen study of the respiratory excursion of the lungs which consisted in taking several roentgenograms at various phases of breathing and uniting them into one single "trick" film. Gött and Rosenthal, in 1912, made use of another procedure, the so-called kymography, which, as is known, consists in intermittently moving a roentgen plate behind a lead screen provided with small slits through which the successive exposures are made. Both of these procedures proved unsatisfactory for the author's purpose and he therefore uses a third, the so-called grid procedure, which was recently introduced by Stumpf. Two exposures are made on the same film in the two phases of respiration (one in deep inspiration and the other in deep expiration), a grid arrangement being displaced in front of the cassette for the successive exposures. The grid consists of parallel iron rods of 0.3 cm. thickness and 0.5 cm. width, imbedded perpendicularly in a wooden frame. The distance between the rods is 0.5 cm. The displacement for the two exposures is exactly this distance so that the image of the thoracic structures in deep inspiration and expiration is obtained in the form of parallel stripes next each other. These stripes are then read with the aid of a densograph (from the bottom upward) and the inspiration and expiration curves plotted for various portions of the chest.

Certain precautions must be taken to insure that the exposure is made under exactly identical conditions. Thus the author simultaneously takes a control roentgenogram of an aluminum wedge on a small film which is fastened next to the regular roentgen cassette and from the two exposures he judges whether the amount of radiation used was the same. For the control of the position of the patient he uses a photographic camera, a lateral photograph of the patient being made during each exposure. The photographs so obtained are superimposed and the correctness of the position and the amount of respiration estimated.

The method is of value in diagnosing certain lesions of the apices which otherwise would escape detection and in studying the various types of respiration. It is admitted, however, that further improvements are necessary.—*T. Leucutia.*

Haudek, M. Durchwanderungspleuritis bei abdominalen Krankheitsprozessen. (Transmigration pleuritis in abdominal disease

processes.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Jan., 1932, *45*, 1–8.

The author, after making routine roentgen examinations of the chest in various abdominal conditions, found that certain secondary changes occur at the base of the lungs. They were observed chiefly in liver abscess, empyema of the gallbladder, free peritonitis, cirrhosis of the liver, pancreatitis, carcinoma of the transverse colon and in one case of unclassified peritoneal condition. The changes consisted, as a rule, in a slight haziness of the lower lung with distinct shadow formations, which had more or less sharp but irregular outlines running horizontally or obliquely, the picture being not unlike that of lymphogenic carcinosis. A mottled or patchy appearance of the shadows was never observed. The pleural sinus was often obliterated by a meniscus-like shadow or by a lamellar opacity along the thoracic wall. Large effusions were observed only in subdiaphragmatic abscesses.

The above shadows were interpreted as being due to pleural changes, consisting chiefly of fibrinous deposits at the lung bases. The involvement of the diaphragmatic pleura and the diaphragm itself was evidenced by elevation of the leaf of the diaphragm and by a limited respiratory motion, which in the later stages were associated with slight irregularities of the diaphragmatic line. Seven case reports are briefly included and illustrated with several roentgenograms.—*T. Leucutia.*

Donzelot, E., and Iselin, Marc. Pleurésies interlobaires et abcès du poumon. (Interlobar pleurisies and abscess of the lung.) *Presse méd.*, Nov. 7, 1931, *39*, 1625–1627.

Kourilsky, in his recent thesis, makes some quasi revolutionary statements concerning the relation of pulmonary abscess to interlobar pleurisy and especially the incidence of this latter. Thus he states (1) that interlobar pleurisy is very rare, there being only a few post-mortem observations in the literature; (2) that pulmonary suppuration is the rule, this being demonstrated in 9 out of 10 cases with uncertain diagnosis, and (3) that he personally has not observed one single case of authentic interlobar pleurisy.

The authors were able to study a case of abscess of the lung which had produced an interlobar effusion. After postural drainage of the abscess, the pleural effusion entirely disappeared, but the abscess persisted for several months. Finally a complete healing ensued. Thus this case proves that the collection of the interlobar effusion was secondary to the abscess, there being an intimate relation between the two conditions.—*T. Leucutia.*

Chéron, A. Radiographie stéréoscopique du thorax de profil chez l'enfant. (Stereoscopic roentgenography of the infant thorax in profile.) *J. de radiol. et d'électrol.*, Aug., 1931, *15*, 455–456.

Lateral stereoscopic roentgenograms of the chest in children are of certain diagnostic value in permitting a spatial estimation of the left and right hilus as well as of the shadows belonging to the roots of the lungs. The right inferior lobe which in the posteroanterior view is obscured by the dome of the diaphragm is particularly well visualized.—*T. Leucutia.*

Kerley, Peter. Congenital diseases of the lungs. *Brit. J. Radiol.*, March, 1932, *5*, 234–240.

Congenital lesions of the lungs are not infrequent but they cannot be diagnosed except by roentgen examination. Especially two groups are of great importance: the so-called azygos lobe, and the anomaly of lobe formation or, more properly speaking, of the bronchial architecture. In connection with this latter the author states that there is a definite and persistent tendency in man for the formation of a fourth lobe in the right lung and a less marked tendency for the formation of a third lobe in the left lung. The fourth lobe in the right lung is present in all quadripeds and is well developed in the higher apes. Its persistence in the primates should have led us to suspect its frequency in man for we still have a long way to evolve before we discard all anatomical traces of our simian ancestry. Schaffner found a well-developed fourth lobe in the right lung in 15 per cent of normal individuals and a third lobe in the left lung in a slightly smaller percentage. In no less than 40 per cent of normal individuals evidence of accessory lobes can be found in a furrow running across the lower part of the lower lobes. The roentgen appearances of the collapsed accessory lobe are characteristic. With increasing deflation the lobe slowly becomes more opaque, its outer border becomes denser and straighter and eventually the whole lobe sinks into the paravertebral groove,

where it appears through the heart shadow as a triangular opacity. In a majority of cases bronchiectatic dilatation takes place in the collapsed lobe and infection sooner or later follows this dilatation. Up to the present many of the accessory lobes have been diagnosed as collapsed lower lobes and the collapse attributed to bronchiectasis.

In discussing the importance of bronchiectatic dilatation of the collapsed accessory lobe the author states that he found that of 60 children, proved cases of bronchiectasis seen at the Royal Chest Hospital, half of them lacked the typical symptoms of bronchiectasis such as cough, expectoration, general debility, toxemia. Therefore he believes that the old theory that infection plays a dominating part in the causation of infantile bronchiectasis must be discarded and that it must be assumed that they are rather on a congenital basis. This is supported also by the fact that at least 60 per cent of the children showed other congenital abnormalities of the bony thorax. If the idea of a congenital lobar origin of bronchiectasis is correct there is only one rational method of treating bronchiectasis with lobar collapse and that is removal of the lobe.—*T. Leucutia.*

Weymuller, Charles A., Bell, A. L. L., and Trivilino, A. A. Roentgenographic changes in the thorax of normal premature babies. *Am. J. Dis. Child.*, March, 1930, *43*, 585–593.

In a previous communication the authors demonstrated the usefulness of a series of roentgenograms taken daily of normal infants during the first fourteen days of life. Since one frequently meets puzzling situations in premature babies, such as unexplained cyanosis, or cyanotic attacks, disturbances of respiratory rates or rhythm, or possible pneumonia of the new-born, the authors concluded that a study of premature infants was especially desirable. These occur even more frequently in premature infants than in normal. No previous control has apparently been reported.

Daily bedside roentgenograms of the thorax of normal premature infants for the first fourteen days of life were made. If there was cyanosis, feeble cry, dyspnea, excessive loss of weight or any other symptom suggestive of abnormality, the films were excluded from the series. Fifteen completely controlled cases were studied, a series of fourteen films for each being made. A portable bedside unit was used, without removing the infant from the incubator. The following factors were employed: 88 peak kv., 30 ma., and a 25 inch target film distance. The patient was placed in the supine position, and an attempt was made to make the films at the height of inspiration.

In general, the lung fields were much clearer than those of the full term infants. There was a characteristic delicacy of structure of all the lung markings in the premature infants, and in 8 of the series this delicacy of structure produced strikingly diminished densities of the lung fields. Whereas most of the full term infants showed increased hilar and peribronchial markings on the first and second days with a gradual tapering off, this was true of but 3 of 15 premature infants. Furthermore, there was so little change from day to day in the premature series that practically any film might have been chosen as characteristic. The authors assume that the decreased density and more delicate structure of the peribronchial trunks observed in premature babies is accounted for by the relatively smaller size of the blood vessels.

In only one child was the interlobar line between the right upper and middle lobes demonstrable. This line was found quite regularly in normal, full term infants, and it varied with position. This one patient was of large size and weight, 2,200 gm., and it is suggested that there may be a weight level beyond which this common finding for larger babies may be found. Weight may possibly determine the density of these tissues.

Most of the full term infants showed definitely larger cardiac shadows on the first and second days. The size of the shadow diminished and became fairly constant in size after the third day. This was true in general of the premature infants studied, although the changes in size were much less striking. When there was decided enlargement (6 cases) during the first three days, the fullness was most marked at the left border. In one case the examination was especially useful. There was definite alteration in the shape of the right side of the heart, in addition to the enlargement common on the first day, as manifested by the enlargement of the right atrial region. At this time no murmurs were heard although they were sought particularly. This fullness persisted and on the fourteenth day a definite systolic murmur trans-

mitted to the vessels of the neck was heard over the region of the pulmonic second sound. From this case, the conclusion is drawn that evidence of congenital heart lesions is not always present on initial examinations and that potentially serious lesions can be overlooked, unless repeated clinical observations and roentgenographic studies are made.

There was variation of the mediastinal shadow in but one infant, in contrast with the decided variation in those of full term infants. Since respiratory excursion is so slight in premature infants the reason for the lack of variation in mediastinal shadow is clear.—*R. S. Bromer.*

Altschul, W. The hilus of the lung in the child. *Radiology*, Dec., 1931, *17*, 1147–1152.

The boundary between the normal and pathologic hilus is indistinct. There is no really normal adult hilus. In children increases in size and density are found which in the absence of clinical symptoms cannot be regarded as pathologic. The author reviewed several thousand chests in an attempt to see when involvement of the bronchial glands can be assumed and when such involvement can be excluded. Since the involved glands may be located in widely different parts of the hilus, routine measurement at any time is of little assistance. Since glandular enlargement is usually localized corresponding to the site of the exciting parenchymal lesion, a uniform expansion points to circulatory stasis. Enlarged glands may be described certainly when the rounded outer borders of the individual glands can be seen. Pulmonary infiltrations are usually separated from the hilus and are not so sharply demarcated. Questionable enlargement should be evaluated through comparison with the glands of the opposite side. The interfering heart shadow may be avoided by slightly rotating the patient. Inequality of the two shadows is decisive for the diagnosis. In acute cases the existing focus in the lung is usually visible, later it may show as strands running from the focus toward the hilus. The activity of the lesion cannot be evaluated because often old fibrotic calcified glands contain active areas. Generally, however, when glands in children heal clinically, they retrogress to normal size; when the primary complex is visible the tuberculous nature of the lesion can be ascertained. Other causes of enlargement as pertussis or influenza are extremely rare. Since certain groups of glands fall within the mediastinal shadow unless greatly enlarged, a negative roentgenogram does not rule out this enlargement.—*E. I. L. Cilley.*

Stewart, Chester A. Pulmonary diseases: 5,816 cases in children; with special reference to the childhood type of pulmonary tuberculosis. *Am. J. Dis. Child.*, April, 1932, *43*, 803–827.

Stewart quotes the definition of the childhood type of pulmonary tuberculosis adopted by the American Sanatorium Association, 1929, namely, the diffuse and focal lesions in the lungs and adjacent tracheobronchial nodes that result from the first infection of the pulmonary tissue by the tubercle bacillus. His report is based on a study of 5,816 children, including 3,981 (68.4 per cent) and 1,835 (31.6 per cent) children having negative and positive Pirquet tests, respectively. In 1,179 children, or 20.3 per cent of the entire group of 5,816 persons, intrathoracic disease was revealed by roentgen examination. The prevailing type of lesions found in these 1,179 children was that produced by the *Mycobacterium tuberculosis*, as shown by the fact that childhood tuberculosis was found in 82.3 per cent (970 instances) of these cases. In summarizing the value of the various methods of detection of the disease, Stewart states that if a value of 100 per cent is assigned to the Pirquet test as measuring its efficiency in the discovery of childhood tuberculosis, the roentgen examination has a reliable efficiency of about 25 per cent, and the physical examination an efficiency of a small fraction of 1 per cent.

Resolving parenchymal tuberculous lesions of first infection (epituberculosis?) were found exclusively in the cases with positive tuberculin tests, constituting about 3.6 per cent (66 cases) of his group. With advancing age, the percentage yearly frequency with which resolving parenchymal lesions were found increased to a maximum of 22.2 per cent in the second year of life, but thereafter tended generally toward a progressive annual decline, and were rarely found after the eleventh year.

Questionable calcifications of the intrathoracic lymph nodes were reported in 1.5 per cent (59 cases) of the 3,981 children whose Pirquet test was negative and in 5.1 per cent (94 cases) of the 1,835 children whose tuber-

culin test was positive. Slight calcifications of these glands were reported in 1.8 per cent (72 cases) of the group with negative tuberculin tests and in 13.5 per cent (247 cases) of the group with positive tests.

Moderate degrees of calcification of the lymph nodes at the root of the lungs were rarely reported (4 cases only) in the 3,981 children with negative Pirquet tests, which for these cases was an incidence of only 0.1 per cent as compared with an incidence of 6.05 per cent (111 cases) for those with a positive tuberculin test.

Marked calcifications of the hilus glands were found less often relatively than the other degrees of calcification previously mentioned, in both the group in which the tuberculin test was negative, and that in which it was positive, being reported in only 0.025 and 1.04 per cent of each group respectively.

Ghon tubercles were discovered in 0.45 per cent (18 children) of the group with a negative Pirquet test, and in 15.2 per cent (279 cases) of those with a positive tuberculin test. The degree of intrathoracic glandular calcification accompanying Ghon tubercles varied from questionable to marked, with the moderate and marked degrees of calcification predominating.

From the standpoint of the appearance of lesions discovered by roentgen examination, childhood pulmonary tuberculosis of first infection is divided into the following three types by Stewart: (1) resolving pneumonic-appearing parenchymal consolidations, which represent early stages of the disease; (2) intrathoracic glandular calcifications of various degrees, which represent late permanent stages of the disease; (3) Ghon tubercles associated with hilar gland calcifications, which represent late and permanent stages of the disease. These various types of lesions merely represent various developmental stages in the evolution of the disease produced by a primary tuberculous infection, between which transitional stages may be noted. The end-result in nonfatal cases is always the same in that calcification of the hilus glands appears, or that Ghon tubercles develop, associated with calcification of the homolateral hilus glands.

In 45 children unmistakable evidence was discovered of the recent development of lesions of the adult type of tuberculosis superimposed on, and postdating previously existing quiescent lesions of the childhood type. Pleural thickenings and effusions were found in only a small percentage of the groups with negative and positive Pirquet tests, but tended, however, to occur with greater frequency in infected than in uninfected children. There was no increase in the incidence of bronchiectasis, pneumonia or pneumothorax among children with a positive tuberculin test as compared with children with a negative Pirquet test. These conditions were found in only a small percentage of the entire group studied.

Stewart believes that slight or questionable calcification of the hilus glands often indicates the discovery of small quiescent tuberculous lesions and that conspicuous calcified deposits establish with great certainty the presence of tuberculosis at the site of calcification. The first infection by the tubercle bacillus produces an unmeasured beneficial immunity but, with it, an easily demonstrable allergy. Reinfection of the lungs of allergic subjects results in adult pulmonary tuberculosis.—*J. C. Rosen.*

Willi, H. Röntgenbefunde bei Masernpneumonien. (Roentgen findings in measles pneumonia.) *Fortschr. a. d. Geb. d. Rontgenstrahlen*, Jan., 1932, *45*, 34–39.

The study is based on an observation of 27 cases, 16 of which were diagnosed clinically as pneumonia, 5 as bronchiolitis, 2 as bronchiolitis and pneumonia, 2 as bronchitis and 2 without pulmonary findings. The conclusion is reached that there are two forms of pneumonia in measles: (*a*) the miliary and (*b*) the confluent lobular. The nearly routinely observed patches and stripes are the result of peribronchial infiltrations and are most probably specific; the larger their number, the more severe the prognosis.—*T. Leucutia.*

Edwards, A. Tudor. Malignant disease of the lung. *Brit. M. J.*, Jan. 24, 1931, *1*, 129–132.

In the lung, carcinoma appears to arise primarily in two situations, the bronchi and the parenchyma. Endothelioma is described. Sarcomata are rare and when they do occur are usually of the spindle cell type.

Diagnosis is made by roentgen examination, before and after induced pneumothorax, and introduction of lipiodol into the bronchi. Bronchoscopy and thoracoscopy are important diagnostic measures.

In growths obstructing the bronchus roent-

gen evidence of atelectasis is seen with displacement of the heart and mediastinum. A dense wedge-shaped area of increased density is observed with the base toward the periphery. Central growths in the parenchyma of the lung appear as an opaque shadow, sharply outlined and without evidence of surrounding pulmonary reaction, as is seen in infective conditions such as abscess. In a certain proportion of cases the center of the growth becomes necrotic and should infection spread in from the bronchi, an abscess surrounded by new growth will result. The author has seen 118 cases of primary malignancies of the lungs. The bronchial carcinomata spread to the mediastinal glands early and little therefore can be expected by surgical removal. The author has one patient upon whom he operated for the removal of a carcinoma arising from the bronchus of the left upper lobe, alive and symptom-free eight months after surgical removal.

Radium therapy of these inoperable bronchial carcinomata is considered. The methods discussed are: (1) Teletherapy, application at a distance of large doses (1 to 4 grams) in a bomb. In 6 patients so treated all died without even temporary improvement being observed. (2) External application of radium plaques on Columbia paste is considered of value only when the growth is near to or involves the chest wall. The author did not observe any permanent cures by this method of treatment but there was a definite relief of the pain in 3 cases in which the chest walls were involved. (3) Radon seeds. For growths in the main bronchi there are definite dangers of perforation into the mediastinum by haphazard insertion of seeds into the growth itself. The author has devised a silver tube which contains 8 radon seeds. This tube is introduced into the bronchus by means of a bronchoscope and left in place four days and then withdrawn by a thread which has been left attached to the tube. For central neoplasms and for those arising peripheral to the main bronchi, which are inoperable, the direct insertion of radon seeds through a thoracotomy would appear to be the method of choice.

Central growths, those arising from the parenchyma, are those which offer the most hope of surgical cure; these, however, are in the minority. Of 118 cases of primary lung malignancies seen by the author only 9 were in this category and of these only one is alive and without symptoms twenty months after operation.

The author states that deep roentgen therapy has proved very disappointing for primary malignant lung tumors. Occasionally the rapidity of development of secondary deposits in the lungs is diminished by deep roentgen therapy.—*J. H. Vastine.*

Sergent, Emile. Bronchiectasies abcédées, abcès bronchiectasiants et abcès bronchiectasiques. (Abscessed bronchiectasis, bronchiectasing abscesses and bronchiectatic abscesses.) *Presse méd.*, Feb. 20, 1932, *40*, 273–276.

The knowledge of dilatation of the bronchi has undergone numerous changes during the last few years, thanks to the systematic application of roentgen study by means of lipiodol. Thus it has been found that dilatation of the bronchi is, as a rule, intimately associated with bronchopulmonary suppurations, abscesses, and pulmonary gangrene, and vice versa. This complex anatomo-clinical and evolutive syndrome induced American authors especially to differentiate a distinct morbid entity which is called bronchiectatic abscess. The observations gained during the past ten years by the author himself have convinced him that the entity is lacking in precision and therefore he proposes that the following three varieties be distinguished: (1) The abscessed bronchiectasis in which the abscess or the gangrenous focus of the lung develops in the form of a complication of a preëxisting bronchiectasis which may be (*a*) acute or subacute and (*b*) chronic. The first may occur in protracted acute bronchopneumonias, whereas the second is the result of the well-known classical picture of chronic dilatation of the bronchi. (2) Bronchiectasing abscess in which a more or less chronic gangrenous focus or abscess of the lung forms the preëxisting factor, the bronchiectasis developing secondarily as a result of the effect of the chronic sclerogenic bronchopneumonic process upon the adjacent zones of the pulmonary tissue. (3) The bronchiectatic abscess, in which abscess and bronchiectasis develop simultaneously and which consequently may be considered as an association of the two. This form manifests itself clinically as suppurating bronchopneumonia, mostly lobar in type, and ends, with a few exceptions which assume a chronic course, nearly always fatally.

In conclusion, the author also briefly considers the various therapeutic procedures, especially emphasizing the value of aspiratory bronchoscopy which is highly recommended.—*T. Leucutia.*

Band, David, and Hall, I. Simson. Postoperative massive collapse of the lung: A clinical and experimental study. *Brit. J. Surg.*, Jan., 1932, *19*, 387–409.

The use of roentgen rays and closer clinical investigation have revealed an increasing number of cases of postoperative massive collapse of the lung. Illustrative cases are cited and the various theories of causation are discussed.

A series of animal experiments is described in which many of the conditions occurring during operation are produced with and without the introduction of gum acacia of varying degrees of viscosity into a main bronchus. From this work it is concluded that the experimental production of massive collapse requires: (1) intrabronchial content of definite viscosity (equal to 75 per cent gum acacia); (2) abolition of the cough reflex, and (3) limitation of the respiratory movement.

In an effort to prevent the occurrence of postoperative collapse, it is recommended that nembutal be substituted for morphine and atropine as preoperative medication and that the anesthesist become proficient in the use of carbon dioxide in maintaining deep regular breathing. The application of tight dressings to the chest, and the occurrence of abdominal distention should also be prevented when possible. Sedative drugs should be prescribed as sparingly as possible in order that the bronchial tree may have a chance to empty itself after operation.

The inhalation of 10 per cent carbon dioxide in oxygen at hourly intervals is of great value after collapse has actually occurred. When this method fails, bronchoscopic removal of the viscid substance from the bronchi must be resorted to.—*C. L. Martin.*

Lazeanu, E. Sur le diagnostic radiologique des abcès du poumon. (The roentgen diagnosis of pulmonary abscess.) *J. de radiol. et d'électrol.*, Nov., 1931, *15*, 608–614.

The study is based on a total of 28 cases of pulmonary abscess observed in the medical clinic of Prof. Nanu-Muscel. In 19 of these the classical hydro-aerial image was found. In the others the abscess was associated with a diffuse, more or less homogeneous opacity, occupying a part or the entire lobe. Successive examinations at short intervals often revealed the presence of a clearer space within the opacity, later leading to the hydro-aerial appearance. Sometimes a multiplicity of the hydro-aeration was observed, no doubt due to multiple abscesses. In other instances the process continued to remain diffuse, leading to an extensive suppuration. In these latter small multiple abscesses were found within nearly completely hepatized lung at the autopsy. In case of healing there was a gradual clearing up of the opacity, with formation of cicatricial, sclerotic tissue. In 2 instances a small cavity persisted, in spite of disappearance of all clinical symptoms, in the center of such sclerotic tissue.

The author emphasizes the fact that successive roentgen examinations are indispensable for the study of the evolution of an abscess. The differential diagnosis includes in the obscure forms, interlobar pleurisy, pulmonary gangrene, infected bronchial dilatations, and rarely cancer of the lung. Within certain limits the roentgen examination may be used also for the prognostic evaluation of the pulmonary abscess. Thus, if the lesion is localized and surrounded by a fibrotic capsule the prognosis is somewhat better, whereas if the infiltration shows a tendency to extend the prognosis becomes grave.—*T. Leucutia.*

Hudson, William A. Lung abscess. Radiology, Jan., 1932, *18*, 1–22.

The first roentgenographic evidence of abscess formation is the appearance of an area of increased density in the region of the bronchial obstruction. The markings of the bronchi distal to the obstruction appear as radiating lines. Succeeding studies show extension until an entire lobe or more may be involved. The usual lung markings become obliterated; later, areas of decreased density may appear. It may be noted that at the most dependent portion of these areas the outline is horizontal.

Abscess cavities are rarely surrounded by recognizable capsules, but appear as defects within boundaries of uniform density. When cavities communicate with a bronchus, free access of air causes their fluid contents to assume a horizontal level. If the exact localization of the abscess is impossible from the plate, de-

pendence must be placed on the findings at endoscopic examination. The roentgenologist will be aided materially if he makes frequent roentgen examinations—a roentgenoscopic study should also be made.

Differential diagnosis.

Lobar pneumonia. A second plate at the end of twenty-four hours should serve to differentiate lobar pneumonia as the consolidation in lobar pneumonia is usually much more rapid in its development than in the lung abscess.

Massive and localized atelectasia have the characteristic findings of a narrow hemithorax, increased density of the involved portion of the lung, and the narrow interspaces with the displacement of the mediastinal contents toward the involved side, and the elevation of the diaphragm.

If empyema is located adjacent to the mediastinum there will be displacement of the mediastinal contents toward the good side, in contrast to no displacement of these structures, as in lung abscess.

A chronic lung abscess can be differentiated from chronic bronchiectasia by the use of lipiodol.

Roentgenologic aid in treatment is discussed and 19 case reports with 45 illustrations are given.—*Ellsworth Johnson.*

Schatzki, R. Die Beweglichkeit von Ösophagus und Magen innerhalb des Zwerchschlitzes beim alten Menchen. (The movability of the esophagus and stomach through the diaphragmatic hiatus in old people.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Feb., 1932, *45*, 177–187.

Åkerlund distinguishes three types of diaphragmatic hernia: (1) the congenital type with short esophagus; (2) the para-esophageal type in which the esophagus enters the abdomen opposite the hernial sac, and (3) the hiatus herniae in which the non-shortened esophagus lies within the hernial sac. The author examined 30 old individuals (23 men, 7 women) between the ages of sixty-five and eighty-three with regard to the possible occurrence of the third type. For this purpose he administered to the patients a thick barium sulphate mixture and examined them in various positions by trying to produce a herniation through increase of the abdominal pressure (chiefly by insufflation of the colon). In 14 cases a displacement of the stomach upwards through the diaphragmatic hiatus was found by simply changing the position; in 8 others by increasing the abdominal pressure with insufflation of the colon and in the rest the findings remained negative. Thus in summarizing, it was found that in a total of 22 out of 30 cases, that is 73.3 per cent, a diaphragmatic herniation of the stomach could be produced, indicating that acquired herniae are a rather frequent occurrence in advanced age. This no doubt is due to the fact that the tissues of the diaphragm become less elastic, that the fat within the hiatus undergoes atrophy and that thus a locus minoris resistentiae which still must be considered physiologic develops. The Åkerlund Type I and II herniae are encountered only very rarely.— *T. Leucutia.*

Blackford, L. Minor, and Booth, William T. Dextrocardia secondary to eventration of the diaphragm. *J. Am. M. Ass.*, March 12, 1932, *98*, 883–885.

Dextrocardia as a part of general transposition of the viscera is not uncommon. When dextrocardia occurs alone eventration of the diaphragm should be suspected, this being the most common cause of the condition. A case is reported which was diagnosed as dextrocardia in infancy but the eventration of the left leaf of the diaphragm which displaced the heart was not discovered until the age of sixteen. No symptoms were experienced from the anomaly and the patient lived a very active life, taking part in strenuous athletics. The possibility that subphrenic symptoms may develop or that the weakened diaphragm may be ruptured is considered.—*E. W. Hall.*

Sparks, J. V. Pulmonary asbestosis. *Radiology*, Dec., 1931, *17*, 1249–1257.

Asbestos is a silicate combined with other minerals. During the manufacturing process workers are exposed to its dust. When pulmonary asbestosis once is established stopping exposure to dust will not arrest the progress of the condition. Pneumoconiosis of a characteristic variety is set up and the lungs contain golden yellow bodies which are also found in the sputum. The symptoms and physical signs are described and the clinical data and post-mortem findings in one case are discussed.

The roentgen appearance is usually quite typical in well-advanced cases, but in early cases it is easily overlooked. The movements

of the diaphragm are limited and its outline is indistinct and irregular. There is clouding in the costophrenic angle which may extend along the costal margin to the apices. The heart outline is poorly defined although clinically no displacement of heart or mediastinum is apparent. Occasionally small irregular calcareous deposits about the size of calcified tubercles, but less dense, are scattered throughout lower zones of the chest.—*Ellsworth Johnson.*

Lamarque, L., and Bert, J. M. Formes anatomo-cliniques des tumeurs médiastinales et leur sensibilité comparée aux radiations. (Anatomo-clinical forms of mediastinal tumors and comparison of their sensitity to radiation.) *J. de radiol. et d'électrol.*, Aug., 1931, *15*, 416–425.

On the basis of two lymphoid tumors of the mediastinum, which are extensively described in the text some roentgenograms being used for illustration, the authors discuss in general the radiosensitivity of all mediastinal tumors. If the aneurysmal tumors and the simple hypertrophy of the thymus are deducted, they may be divided into two main groups: (1) tumors of lymphoid nature and origin, and (11) non-lymphoid tumors.

1. Lymphoid tumors of the mediastinum. These may be subdivided thus: (*a*) Lymphoid tumors without modification of the blood picture. These may be gain subdivided: (1) typical lymphocytomas of Menétrier, also called lymphomas or lymphoadenomas; (2) atypical lymphocytomas, such as lymphosarcoma, lymphadenoma or malignant lymphadenoma. All these tumors are the most radiosensitive of the entire group, they virtually melting away following roentgen exposure so that a diminution in the size within eighteen hours after the first irradiation is not infrequent. (*b*) Lymphoid tumors with modification of the blood picture. If the leucosarcomatosis of Sternberg, also called sarcoleucemia, which is of a purely theoretic interest and represents a transitory form, is deducted, one may distinguish two main types in this group: (1) The mediastinal form of malignant lymphogranulomatosis, and (2) the mediastinal form of lymphoid leucemia. The response of malignant lymphogranulomatosis to radiation varies according to whether the lesion is in the first or second stage of evolution. In the first stage there is a very favorable rapid and prolonged response while in the second stage the response is similar to that in generalized carcinomatosis, not infrequently the irradiation remaining inefficacious. The acute and the pleuropulmonary forms likewise are more radioresistant. In the lymphoid leucemia the immediate response is remarkable, large adenopathies disappearing within a short time.

11. The non-lymphoid tumors of the mediastinum. These may be malignant, such as fibrosarcoma, round cell sarcoma, cancer of thymic or thyroid origin, teratoma, etc., or benign, such as lipoma, chondroma, fibroma, adenoma, and dermoid cyst. Whereas in the malignant forms irradiation may bring about a marked reduction in the size of the tumor (within six weeks) without complete disappearance, in the benign forms the response will be nil.

It results from the above that the anatomic structure of the tumors of the mediastinum forms the fundamental element in estimating the radiosensitivity. The administration of the so-called therapeutic "test dose" which is recommended by several authors leads not infrequently to a correct differential diagnosis.

There can be no doubt that radiation therapy, though in the largest number of cases admittedly of only temporary value, represents one of the most powerful curative or palliative agents in the treatment of the principal mediastinal tumors. A bibliography is appended.—*T. Leucutia.*

Mowat, W. J. The radiographic demonstration of the vena azygos. *Brit. J. Radiol.*, Dec. 1931, *4*, 690–692.

During the study of films of the barium-filled esophagus in the routine anterior oblique position, a notching was occasionally detected which could not be explained. After numerous studies it was concluded that the abnormal shadow must represent the end-on view of the horizontal portion of the vena azygos.—*T. Leucutia.*

Kahlstorf, A. Ueber eine orthodiagraphische Herzvolumenbestimmung. (On an orthodiagraphic determination of the heart volume.) *Fortschr. a. d. Geb. d. Rötgenstrahlen*, Feb., 1932, *45*, 123–146.

Moritz, Palmieri, Lysholm and Schatzki worked out a method for the determination of the heart volume consisting in a plastic

model of the heart constructed on the basis of the orthodiagraphic findings. This method has the great advantage that it permits the estimation of the form and position of the heart, but it consumes considerable time and therefore is unpractical. Rohrer introduced a new method based on the principle that the volume of any body of a given form is the product of the surface area of its parallel projection multiplied by the middle linear extension in the projected direction. In the heart, the surface area corresponds to the sagittal orthodiagram while the middle linear diameter must be determined indirectly. If the organ is considered as an approximate paraboloid, the middle linear diameter may be obtained by multiplying the constant (0.59 for the paraboloid) with the sagittal diameter of the heart as measured in the lateral projection. By making the necessary corrections for the heart model (constant =0.63), the following formula is established: heart volume=0.63×surface area×maximum sagittal diameter.

The author has arrived at the formula of Rohrer in an entirely different way. He considered the heart as a mathematical body occupying a position between an ellipsoid and a paraboloid, and by mathematical calculation he deducted the same formula by likewise taking the constant as 0.63. On the basis of numerous anatomic specimens he found that the volume of the heart is independent of the position of the heart, the source of error in the individual cases amounting to only about 5 per cent. He then determined the normal values for the volume of the heart in adults, arriving at the conclusion that this value is dependent only on the body weight, being its linear function. The heart quotient was determined by dividing the heart volume expressed in cubic centimeters by the weight expressed in kilograms, and it was found that a quotient below 8 in men and 7 in women indicates a small heart, while a quotient over 11 indicates a large heart. The heart volume in women is, on an average, 75 c.c. smaller than in men. This difference is explained on the basis of reduced metabolism and of lessened function of the circulatory apparatus. There is no parallelism between the heart volume and the surface area of the orthodiagram. With like volume a divergence as high as 20 per cent may be encountered in the value of the surface area.

The knowledge of the heart quotient is important inasmuch as it gives information concerning the size of the heart and in pathological conditions it aids in the differential diagnosis of borderline cases. It is interesting that the normal heart responds to excessive labor with marked decrease in its volume, while the pathological heart shows a tendency towards increase.—*T. Leucutia.*

Zdansky, Erich. Zur Kritik der Kreuzfuchsschen Aortenmessung. (On the critique of the Kreuzfuchs aortic measurement.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Jan., 1932, *45*, 40–45.

In 1920 Kreuzfuchs recommended for the roentgen mensuration of the aorta the contrast filling of the esophagus and the measurement of the distance of the most prominent point of the left aortic knob from the most prominent point of the so-called aortic bed, as evidenced by the pressure of the aorta on the barium filled esophagus. It is admitted that the dimension so obtained is a little too wide due to the fact that the esophageal wall is included in the aortic image. However, since the thickness of the wall of the esophagus is only about 2 mm. the error may be considered negligible.

Several authors have criticized the value of the above method and this no doubt is responsible for its not very widespread practical application. The author analyzes the method from the standpoint of (1) its accuracy; (2) its practical application, and (3) its technical applicability, and arrives at the conclusion that with certain precautions, most of the sources of error can be eliminated. Only in pure mitral vitium and in certain processes with displacement of the mediastinum, esophagus and aorta is the method unreliable.—*T. Leucutia.*

Herscher, Haret, and Frain. Communication entre l'artère pulmonaire et une ectasie de l'aorte ascendante. (Communication between the pulmonary artery and an ectasia of the ascending aorta.) *Bull. et mém. Soc. de radiol. méd. de France*, Nov., 1931, *19*, 445–448.

The authors observed a case of rupture of an aneurysm of the ascending aorta into the pulmonary artery. The roentgenoscopic as well as the roentgenographic examination revealed a butterfly-like shadow of the median portions of the lungs, the heart silhouette in the postero-

anterior view appearing almost completely obscured. In the left anterior oblique position no prominence of the left auricle was noted. As a whole, there was a notable augmentation of the cavities of the heart, especially of the right auricle and right ventricle, and there was a slight prominence of the median arch at the left border. Inasmuch as the clinical diagnosis was that of a pulmonary stenosis, this could not be contradicted on the basis of the roentgen findings. The patient later died with pronounced asphyctic phenomena and at post mortem examination spontaneous rupture of an aneurysm of the ascending aorta into the pulmonary artery was found.

A communication between the aorta and pulmonary artery whether it be congenital or acquired is quite rare. Bonte, in 1929, was able to collect in his thesis 32 cases. According to Sibson aortic pulmonary communication is encountered in 8 per cent of all aneurysms.

It is concluded that the roentgenologic symptomatology varies. There are no characteristic diagnostic signs, whether the aneurysm is actually demonstrated or an enlargement of the right ventricle is the only manifestation.—*T. Leucutia.*

Ravina, A., Sourice, A., and Benzaquen, L. L'angiographie et l'angiopneumographie. (Angiography and angiopneumography.) *Presse méd.*, Feb. 20, 1932, *40*, 287–291.

For the last few weeks the authors have carried out a series of experiments in animals (especially dogs) for the visualization of the arterial system. Sodium iodide, abrodil and tenebril were used as opaque media. The substance was first injected directly into the right ventricle and later, by means of a sound which was introduced from the veins of the neck, either into the right auricle or right ventricle. It is too soon as yet to form definite conclusions but it seems that the method has some value in the study of certain physiologic phenomena of the circulatory system.—*T. Leucutia.*

Edgerly, E. T., and Spilman, H. A. Pneumothorax; a clinical and roentgenologic consideration. *Radiology*, Dec., 1931, *17*, 1267–1269.

The object of this paper is to present various findings in the human chest in connection with the presence of air in the pleural cavity, especially as observed in cases of pulmonary tuberculosis. One is impressed with the necessity for adequate roentgenoscopic and roentgenographic examinations in the selection of cases and the application and control of collapse therapy. For the proper correlation of the roentgen findings, the physical examination, and the clinical course, absolute cooperation between clinician and roentgenologist is essential. Indications for artificial pneumothorax are given.—*Ellsworth Johnson.*

ABDOMEN

Reynolds, G. S. The response of the gastrointestinal tract to external electric stimulation. *Radiology*, Dec., 1931, *17*, 1276–1280.

In the treatment of chronic constipation it was felt that valuable information could be secured by roentgenoscopic observations of the stomach and colon while they were under electric stimulation. Electric stimulation of the external abdominal muscles over the barium-filled stomach did not produce, during the time of roentgenoscopic observation, any consistent or specific changes in gastric tone or peristalsis. Relatively large amounts of current seemed to decrease peristalsis, while smaller amounts of current seemed occasionally somewhat to increase gastric peristalsis. Electric stimulation over the barium-filled colon produced the following changes: Ascent and descent of colonic flexures and transverse colon; secondary to this ascent and descent of the colon, an alternate lengthening and shortening of the colon occurred; a certain amount of massage effect on the colon was noted. The experiments emphasized the great value of electric stimulation in developing the abdominal muscles. These conclusions are based on the immediate effects of electric stimulation of the gastrointestinal tract and do not necessarily carry any implications as to the results obtainable in a series of treatments.—*Ellsworth Johnson.*

Walzel, P. Zur röntgenologischen Beurteilung des Situs inversus viscerum totalis. (On the roentgen diagnosis of situs inversus viscerum totalis.) *Fortschr. a. d. Geb. d. Rontgenstrahlen*, Feb., 1932, *45*, 157–159.

The author briefly describes a case which came to operation with symptoms of acute appendicitis. The information gained from the patient that his heart lay on the right side led the author to suspect situs inversus viscerum totalis and therefore he made the incision on

the left side. Following recovery, the patient had several roentgen examinations and the diagnosis of situs inversus viscerum totalis was confirmed. A left-sided appendix is encountered also in mesenterium ileocoecale commune, in left-sided position of the colon, etc.—*T. Leucutia.*

Piot, Étienne, Goubert, Jacques, and Picarda. Diagnostic radiologique des périviscérites. (Roentgen diagnosis of perivisceritis.) *J. de radiol. et d'electrol.*, Dec., 1931, *15*, 671–679.

Perivisceritis necessitates a careful study on the part of the roentgenologist. Since adhesions can be detected only by indirect signs which vary according to the site of the lesion, a systematic examination of the entire gastrointestinal tract is always indicated. The bulk of information is gained through roentgenoscopic study, roentgenograms being made only for confirmation. It is often advisable to repeat the examination several times.

The author briefly describes the more usual roentgen findings in perigastritis, periduodenitis, perijejunitis, peri-ileitis and pericolitis. If from the beginning an obstruction of the small intestine is suspected, he advises a special technique which is as follows: The patient is placed without preparation on the roentgenoscopic table and examined in dorsal, lateral, semi-inclined, etc., position, for the demonstration of gaseous distention of the loops of the small intestine. Then a tablespoonful of barium (emulsified in paraffin oil) is administered and its passage carefully observed. The patient is left on the roentgenoscopic table during the passage of the barium through the entire small intestine and examination made at repeated intervals. To prevent eventual radiodermatitis more penetrating rays with 2 mm. Al filter and very small diaphragms are used, the position being varied frequently. The procedure may be applied even in case of complete stenosis without too much risk to the patient.—*T. Leucutia.*

Drey. Die Bedeutung des Absaugens des Mageninhaltes für die Darstellung des Schleimhautbildes. (The significance of the aspiration of the gastric content for the visualization of the mucosal relief.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Feb., 1932, *45*, 147–156.

The author advises that the contents of an empty stomach be aspirated before proceeding to a roentgen examination for the demonstration of the gastric folds. Such a procedure, especially in the cases with retention, by removing the disturbing secretion and food remnants, permits a better demonstration of the mucosal relief. In cases of suspected ulcer, the examination is repeated after atropine administration for a period of six weeks. By paying attention to these factors, the author was able to increase the correctness of his diagnoses of gastric conditions by about 30 per cent. Nine cases are briefly reported and illustrated with several roentgenograms to prove the value of the method.—*T. Leucutia.*

Sandera, Robert. Kombinierte Kontrastdarstellung des Canalis egestorius. (Combined contrast demonstration of the canalis egestorius.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Jan., 1932, *45*, 57–73.

The canalis egestorius merits greater roentgen attention for several reasons: First, it forms more often the seat of lesions than the rest of the stomach; second, the ulcers occurring in this region are more apt to undergo carcinomatous degeneration; third, the simple ulcers, because of the greater motility of this part of the stomach, are apt to show a more chronic course, and fourth, lesions associated with transmission through the lymphatic system (originating from the pancreas, duodenal bulb, gall-bladder, transverse colon, etc.) are more apt to produce certain deforming changes of the canalis. Several methods have been advocated for the study of this important portion of the stomach, but the author believes that the so-called combined method is the best. This consists in the use of barium sulphate, umbrathor and air. First 350 c.c. of the usual baryt suspension is administered, the water content of the suspension being changed according to indications and a certain amount of sodium bicarbonate being added to neutralize the acidity of the stomach (1 to 2 gm. for anacid or subacid and 2 to 4 gm. for hyperacid or normal stomach). Following completion of the examination with the barium filling, the umbrathor is injected under a very mild pressure. The prior neutralization of the acidity of the stomach allows the better adherence of the umbrathor. If the information gained is still unsatisfactory, air is injected finally under a

pressure not exceeding 50 to 100 mm. on a Recklinghausen manometer. It must be mentioned that both the umbrathor and air are injected by means of a sound, either in the erect or the recumbent (left lateral) position.

The method is of value especially in demonstrating adhesions around the canalis egestorius, which may manifest themselves as transverse folds on the posterior wall of the canalis, or as annular folds, or finally as flattening of the lesser curvature, excentric distentions towards the adherent part, displacement of the pylorus and bulb, etc. Small localized infiltrations of the walls, whether of ulcerous or neoplastic nature, may also be demonstrated. Despite its great value, the procedure is advocated only as auxiliary to the well-known routine methods of examination.—*T. Leucutia.*

O'Sullivan, John. Some recent developments in the radiological examination of the gastro-intestinal tract. *Brit. J. Radiol.*, Feb., 1932, *5*, 97–106.

As the author states, the purpose of this article is to draw attention to refinements that have been evolved in the roentgen study of the gastrointestinal tract within recent years. These developments fall under two heads: (1) a detailed study of the mucous membrane and (2) the employment of snapshot instantaneous photography, this latter being especially applied to the study of the esophagus and the duodenum.

In the following the appearance of the mucosal relief in the normal and in various pathological conditions is discussed. A special chapter is reserved for gastritis with its three types (atrophic, hypertrophic and granular type), for the gastric ulcer and neoplasm, the value of the method in the diagnosis of early malignant changes being especially emphasized, and for the study of the arrangement of the mucosal folds in the duodenum. In the large intestine the relative value of the barium meal, of the suspension enema, combination of air and barium filling and the relief method of examination is considered. The article is well illustrated.—*T. Leucutia.*

Kadrnka, Silvije. Étude des muqueuses digestives par des colloïdes opaques. Imprégnation de la muqueuse du gros intestin avec de l'umbrathor. (Study of the digestive mucosa by means of opaque colloids. Impregnation of the mucosa of the large intestine with umbrathor.) *J. de radiol. et d'électrol.*, Nov., 1931, *15*, 585–607.

In this article the author deals extensively with the roentgen examination of the colon by means of umbrathor, using numerous very beautiful roentgenograms for illustration.

The method of examination is as follows: The previous evening the patient takes a mild purgative (castor oil) and partakes of a supper consisting only of liquid food with exclusion of fruits and vegetables. The morning of the examination two lukewarm enemas (1½ liters) are given with one hour interval and the examination is made on an empty stomach, usually 45 to 60 minutes after the last enema. The umbrathor is injected with a 200 c.c. syringe which is attached to an enema tube, the amount varying from 100 c.c. for children to 200 c.c. in adults. To insure a uniform coating of the mucosa of the bowel the patient is laid in various successive positions (left side during passage in the sigmoid and descending colon, knee-chest or Trendelenburg position during passage in the splenic flexure and transverse colon and right lateral position during the passage through the hepatic flexure and ascending colon) and the injection is made very slowly (from 5 to 10 minutes). If a check-up examination reveals that a good coating has not resulted the bowel lumen is distended by additional injection of umbrathor diluted with ½, ⅓ or ¼ amount of distilled water, the total injection never exceeding 350 c.c. umbrathor or 600 c.c. fluid. In some instances it is necessary to apply manipulation to hasten the passage of the umbrathor through certain parts of the bowel. After a uniform distribution of the umbrathor is obtained, roentgenograms are taken and the bowel evacuated. Following this, air is insufflated under roentgenoscopic control, being careful to proceed very gently. Here again the patient is laid in various positions to insure a better passage of the air.

After discussing in detail the normal appearance of the colon, both with the collapsed and distended lumen, the author describes the findings in 13 cases of pathologic colons to prove the value of the method The opinion is expressed that as a whole the method is superior to that of the barium enema. The opaque layer of umbrathor, because of its chemical adherence, produces a more uniform coating of

the colonic mucosa with increase in the degree of opacity. Moreover the umbrathor, inasmuch as its impregnation depends on the amount of secretion of the bowel mucosa, gives additional information with regard to the function of the bowel. Thus in a subacute hypertrophic colitis, the opaque layer is not only inforced due to enlargement of the mucosal folds but is at the same time thickened due to increased secretion (which leads to increased precipitation of the umbrathor). On the other hand, in atrophic sclerotic colitis impregnation of the mucosa is obtained only with great difficulty or not at all, due to the fact that the secretion of the bowel mucosa is entirely absent or at least qualitatively changed from that of the normal. In deep-seated lesions (stenosis, penetrating ulcers) the after injection of air, leading to distention of the lumen, will aid in estimating the various form changes. Of course numerous errors of interpretation may occur, especially if the technique is not carried out properly. But a repetition of the examination in such instances will as a rule help to arrive at the correct diagnosis. The conclusion is reached that the method is of great practical importance. Its chief advantage is that, as stated above, in addition to the morphologic changes, it gives information concerning the functional disturbances of the colonic mucosa. A bibliography of 22 references is appended.—*T. Leucutia.*

Gilbert, R., and Kadrnka, S. L'examen de la muqueuse des voies digestives au moyen de l'umbrathor. (Examination of the mucosa of the digestive tract by means of umbrathor.) *Bull. et mém. Soc. de radiol. méd. de France*, March, 1931, *19*, 101–104.

In making a comparative study between the effect of barium and umbrathor on the visualization of the mucosal relief, the authors found that the latter is of greater value in all parts of the intestinal tract in which it can be associated with the insufflation of air (pneumogastrography, pneumo-appendicography, etc.).

In the present article the appearance of the mucosal folds in the normal, in chronic hypertrophic colitis, ulcerous colitis, tuberculosis, and tumefactions, is briefly discussed.—*T. Leucutia.*

Cottenot, Chérigié, Le Sauce, and Meyer-Oulif. Exploration radiologique du tube digestif au moyen de sels de thorium. (Roentgen exploration of the digestive tract by means of thorium salts.) *Bull. et mém. Soc. de radiol. méd. de France*, Oct., 1931, *19*, 376–380.

Thorium salts form good opaque media because of the very high atomic weight of the thorium (232.15). Kalkbrenner was the first to recommend the use of thorium dioxide (known as umbrathor), which since then has been endorsed by many other investigators. The flocculation of this substance on the surface of the mucosa of the gastrointestinal tract is explained by the fact that the secretion of the bowel neutralizes the electric charge of the colloid, thus leading to precipitation. A more minute study of the problem, however, shows that such a conception may lead to many errors. Thus, the flocculation of a colloid does not always follow the rule of the equimolecular proportions. Umbrathor, for example, is flocculated by small quantities of water of minimum alkalinity. Furthermore, the flocculation comprises three stages: (1) the stage of micellar enlargement which is visible only ultramicroscopically; (2) the stage of micellar agglomeration which is demonstrable nephelometrically, and (3) the stage of total separation of the agglomerated micellae from the intermicellar fluid. This latter is the only one demonstrable roentgenologically and to the unaided eye. Inasmuch as it may assume the most unusual aspects, numerous errors of interpretation may occur. For this reason, the authors recently have completely abandoned the use of the colloidal contrast media and they have prepared some new preparations which are of a crystalloid character. These preparations contain chiefly thorium dioxide, ThO_2, and the insoluble phosphate salts of thorium $(PO_4)_4Th_3$ and $(PO_4)_3Th\ H_2H_2O$. They possess increased roentgen opacity, very marked adherence, considerable power of diffusion, perfect stability absolute atoxicity and practically no pharmacodynamic or radioactive effect. Especially three products proved of value: (1) For the examination of the gastric mucosa the so-called mucothor is used, which contains thorium dioxide, 10 gm., mineral excipient, 5 gm. and sodium bicarbonate, 3 gm. The product is a slightly saline white powder. It is intimately mixed with the yolk of an egg and administered in this form to the patient. The sodium bicarbonate is added in order to produce a slight

distention of the stomach by the CO_2 which is liberated by the action of the gastric acid. The patient is placed in various positions until a good impregnation of the mucosal folds is obtained. (2) For the total opacification of the stomach, pulvothor is used, which contains thorium phosphate, 90 gm., mineral excipient, 35 gm. and powdered gum, 35 gm. This product is mixed with water and well shaken until a gum-like emulsion is obtained. (3) For the opacification of the intestine a special pulvothor is used which contains thorium phosphate, 80 gm., mineral excipient, 70 gm. and sodium sulphate, 5 gm. This product also is supplied in the form of a powder but non-sugared milk instead of water is used for its dilution.

The conclusion is reached that thorium salts are of great value in the roentgen examination of the gastrointestinal tract and that the crystalloid forms give the best results in the visualization of the mucosal relief.—*T. Leucutia.*

Dwyer, Maurice F. Gastric tumors. *Radiology*, Jan., 1932, *18*, 80–87.

Approximately 10 per cent of patients consult a physician on account of gastric symptoms and only 15 per cent of these have organic lesions in the stomach or duodenum to account for their symptoms. A gastric tumor occurred in 3.2 per cent of the patients in which 111 gastric cancers, 3 benign tumors, 1 hair-ball and 2 cases of gastric syphilis were found.

The roentgenologist seldom fails to diagnose gastric cancer, yet, the majority of gastric cancers are far advanced at the time of diagnosis. A patient who gives a history of chronic dyspepsia and whose gastric secretions show the presence of free hydrochloric acid may have a cancer of the stomach. In the author's series of patients with gastric carcinoma, 38 per cent gave a history of dyspepsia averaging ten years. Seventy per cent of these had free hydrochloric acid in the gastric contents. A benign tumor of the stomach, although rare, may be the cause of an atypical gastrointestinal complaint, anemia, loss of weight, and weakness. The value of careful palpation of the partially filled stomach during roentgenoscopy cannot be emphasized too strongly. It is inadvisable to diagnose inoperable carcinoma from palpation and the roentgenologic examination alone. The patient should be given the benefit of exploration unless there are skin metastases or fluid in the peritoneal cavity.—*Ellsworth Johnson.*

Brooksher, W. R., Jr. Linitis plastica. *Radiology*, Dec., 1931, *17*, 1176–1194.

The literature is reviewed and the pathology described in considerable detail. The term "linitis plastica" is worthy of retention as descriptive of the gross deformity, but, from the pathologic viewpoint, the classification of Dwight as either fibromatosis or carcinoma, diffuse or local in its extent, is considered more suitable. It is evident from the work of Thompson and Graham that fibromatosis, whatever the histological diagnosis, may occur without the presence of cancer.—*E. I. L. Cilley.*

Teschendorf, Hans J. Beitrag zur Reliefdiagnostik des Dickdarms. (Contribution to the relief diagnosis of the colon.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Jan., 1932, *45*, 46–56.

The following method is used: After the preparation of the patient, a routine barium enema is applied in supine position. Then the enema is evacuated and roentgenograms of the mucosal relief are made with localization to that particular area. In case of stenosis, or suspicion of stenosis, of the bowel lumen, inflation with air is added. Barium sulphate (350 grams in 1000 c.c. water) is used as the contrast medium. It is concluded that the method is of great practical value. The appearance of the mucosal relief in the normal, in colitis, in carcinomatous changes and especially in intestinal polyps is described in detail and illustrated with numerous roentgenograms. The possible sources of error are also considered.—*T. Leucutia.*

Pendergrass, R. C. The roentgen diagnosis of duodenal diverticula. *Radiology*, Dec., 1931, *17*, 1216–1229.

An increasing number of cases is being reported, the frequency varying from 0.5 to 5 per cent. Odgers classified duodenal diverticula into (1) primary pouches confined to the duodenum beyond the first portion arising without any coincident pathology; (2) secondary pouches occurring only in the first part and due to chronic duodenal ulcer or traction from adhesive bands, and (3) Vaterine pouches. The roentgenologic diagnosis of duodenal diverticula is discussed with reference to: (*a*) media

used; (*b*) roentgenoscopy; (*c*) roentgenography; (*d*) suggestive roentgen findings such as a more or less spherical shadow in or near the concavity of the duodenal shadow separate from the duodenum, yet in definite relation to it, persistence of shadow after clearance of stomach, movability of the shadow about a fixed point, usually no tenderness coincident with shadow; (*e*) types of diverticula with variations in roentgen appearance. The primary type is rounded, ovoid or funnel-shaped, rarely tubular; the secondary type has many variations in shape and is irregular and pointed in outline; (*f*) differential diagnosis from barium-filled structures such as ulcer craters, redundancies, traction pouches, etc., as well as shadows other than barium such as gallstones, renal calculi, calcified glands, etc.—*Ellsworth Johnson.*

Gutmann, René-A. A propos de l'ulcère duodénal de face. (Apropos of duodenal ulcer en face.) *Bull. et mém. Soc. de radiol. méd. de France*, Oct., 1931, *19*, 368–371.

The author discusses several diagnostic points of the duodenal ulcer en face. (1) From the topographical point of view, there is marked variation between the operative and roentgen findings, nearly all duodenal ulcers appearing at operation en face, whereas roentgenologically they are situated chiefly on a border. According to the author, this is due to the fact that the niche, which as a rule sits en face, remains unrecognized and that the pseudo-diverticular deformity produced secondarily on the border is diagnosed. Contrary to what was heretofore believed duodenal ulcer en face represents the most frequent and most important type of all ulcers of the bulb. (2) There is also a great difference in the morphological appearance of the ulcer at roentgen examination and on the operative table. Thus the most extraordinary forms (coral, orchid, maltese cross, butterfly, tube-shaped, etc.) may appear on the roentgenograms, whereas at operation the ulcer is nearly always found to be smooth with very little deformity around it. Åkerlund thought that the manifold roentgen appearance was due to edema of the mucosal and submucosal tissues. The author entirely endorses this opinion with the addition that submucous edema is the rule in all duodenal ulcers, spasms appearing quite rarely. If the edema is annular, it may appear in the form of a halo in the roentgenogram. (3) The acceptance of the notion of intrabulbar edema precludes the use of compression as so often advocated. (4) Inasmuch as most duodenal ulcers do not appear at roentgenoscopic examination, the taking of serial roentgenograms is of prime importance. —*T. Leucutia.*

Bargen, J. A., and Weber, H. M. Clinical and roentgenologic aspects of chronic ulcerative colitis. *Radiology*, Dec., 1931, *17*, 1153–1157.

The organism of immediate etiologic significance in chronic ulcerative colitis is the streptococcus. The underlying lesions are large shaggy ulcers with intervening strips or islands of mucosa. These islands are granular in appearance, bleed easily, and the diffuse inflammation of the wall results in narrowing of the lumen. The diffuse nature of the disease which involves all coats of the intestinal wall produces a characteristic picture. In about 20 per cent the disease is confined to the rectum and if the disease is of short duration there may be no roentgenologic evidence or the only sign may be that of extreme hyperirritability. Later in the disease the ampulla is markedly narrowed and exhibits a series of coarse linear striations. As the disease progresses, thickening of the wall takes place as do contraction and shortening of the bowel. From a soft pliable, thin-walled, gently winding and twisting tube, the colon becomes a thick-walled, hard, inflexible, stiff straight pipe with a small lumen. Occasionally one or several contracted areas give the bowel the appearance of "a string of sausages." If destruction of the mucous membrane is superficial, the contour of the lumen of bowel may be smooth or feathery and moth-eaten; if the ulcerations are deep the contour is rough and many niche-like projections are seen. Very rarely there are localized areas of chronic ulcerative colitis with involvement of distal segments and rectum.—*Ellsworth Johnson.*

Aubourg, Paul. Examen radiologique de 26 caeco-sigmoidostomies. (Roentgen examination of 26 ceco-sigmoidostomies.) *Presse méd.*, Jan. 23, 1932, *40*, 125–127.

The author was able to collect a series of 26 cases in which a ceco-sigmoidostomy had been performed for various reasons, the clinical symptomatology always being dominated by a chronic intestinal stasis. A re-examination by

means of opaque meal and opaque enema at different intervals following the operation led to some interesting observations. In 21 of the cases the operative results were excellent and the roentgen examination was made merely as a check-up; in the other 5 the operations led to no result and therefore the purpose of the roentgen examination was to determine the exact nature of the pathologic condition. In injecting the opaque enema it was found that this had entered in all cases both the left colon and the right colon (through the ceco-sigmoidostomy) simultaneously, giving the appearance of a Y. The opaque meal demonstrated, however, that only one-tenth of the substance had passed through the ceco-sigmoidostomy, the remaining nine-tenths having been eliminated through the usual route. It is probable that in the 21 cases in which excellent clinical results were obtained the ceco-sigmoidostomy led to a good drainage of the secretion of the cecal fluid and that this was responsible for the disappearance of the symptoms. In the 5 cases in which no improvement was obtained, the roentgen examination revealed a rather large number of gas pockets in the colon, especially in the hepatic and splenic flexures. It is probable that this accumulation of gas which clinically has produced quite severe spastic crises, is similar to that observed in pneumocoly and aerocoly and therefore the author proposes the name of hyperpneumocoly. A study of the time of evacuation revealed that in the 21 favorable cases the stasis was reduced or entirely disappeared, whereas in the 5 unfavorable cases it continued uninfluenced.—*T. Leucutia.*

Aimé, Paul. L'exploration radiologique des voies biliaires à l'aide du lipiodol, dans le pancréatites. (Roentgen exploration of the biliary paths with the aid of lipiodol in pancreatites.) *J. de radiol. et d'électrol.*, Dec., 1931, *15*, 680–684.

The injection of biliary fistulae by means of lipiodol following operation in pancreatitis (cholecystostomy in 2 cases and drainage of the choledochus after cholecystectomy in one case) proved of certain diagnostic value in outlining the biliary passages. It is interesting, however, that the opaque substance, after filling the gall-bladder and the cystic duct, contrary to what one would expect, re-descended into the hepatic duct and its three branches and only after filling these passed through the ampulla of vater into the duodenum. The progression of the lipiodol continued even when there was no pressure applied to the syringe. The procedure was found to be entirely painless and without danger. The article includes some very illustrative roentgenograms of the biliary passages.—*T. Leucutia.*

Silverman, Daniel N. Spontaneous elimination of intestine with temporary recovery: report of a case. *Radiology*, Dec., 1931, *17*, 1208–1215.

The author reviews the literature briefly and describes in great detail the case of a woman past middle life in which two separate segments of the intestine were passed by rectum at different times.—*E. I. L. Cilley.*

Elman, Robert, and Graham, Evarts A. The pathogenesis of the "strawberry" gallbladder. (Cholesterosis of the gallbladder.) *Arch. Surg.*, Jan., 1932, *24*, 14–22.

Moynihan, in 1909, first called attention to small yellowish spots like sand or grit on the mucosa of the gallbladder. MacCarty, because of the appearance of the organ in these cases, used the descriptive term of "strawberry" gallbladder, while Lichtwitz in 1914, was the first to observe that the small yellow deposits were cholesterol. Boyd published the first detailed study of the pathology of this remarkable condition. For a time its existence was generally overlooked, but in recent years it has become more generally known and is now claimed to comprise about one-fifth of all types of diseased gallbladders removed at operation.

Aschoff was apparently the first to maintain that cholesterol is normally taken up by the wall of the gallbladder from the bile. The theory has been generally adopted that the extensive cholesterol deposits found in the "strawberry" gallbladder are the result of a disturbance in the normal absorbing power of the gallbladder for this substance. In contrast to this view, evidence has been obtained in a series of experiments in the laboratory of the authors that seem to show: (1) the gallbladder does not absorb cholesterol; (2) it has the power of excreting cholesterol, and (3) inflammation may accelerate this excretion.

In support of these contentions the following experiments were conducted. 1. When the gallbladder was isolated by ligature of the

cystic duct, the bile therein after a sojourn of from two to sixteen days came to contain a larger amount of cholesterol in all but one of nine experiments. 2. Experiments designed to compare bile subjected to gallbladder influence with that flowing directly from the liver, in the same dog, showed a much greater concentration of cholesterol in the former even when one corrected for the inspissating effect of the gallbladder. 3. Analyses of "white" bile, a product obtained from the isolated bile ducts, showed the presence of cholesterol, which suggests that the entire biliary tract is able to secrete this substance. 4. Comparative analyses of gallbladder and hepatic bile from the same source (human as well as canine) showed that the cholesterol content of the former is much greater than can be accounted for by concentration of the bile.

The authors, in addition, show that infection is the factor of major importance in the pathogenesis of the "strawberry" gallbladder.—*Karl Kornblum.*

GYNECOLOGY AND OBSTETRICS

Macdonald, Colin. Some aspects of obstetrical radiography. *M. J. Australia*, March 19, 1932, *1*, 398–406.

The author presents a comprehensive exposition of the employment of the roentgen ray in obstetrics. He states: (1) so far there is no evidence to prove that diagnostic roentgenography during pregnancy is harmful; (2) pelvic radiation treatment prior to conception is harmless so far as the health and development of subsequent children are concerned; (3) radiation therapy of a growing embryo in utero, if large intensities of exposure are employed, is likely to result in the birth of a defective child, and (4) irradiation as a means of temporary sterilization or abortion does not appear to be dependable. Five methods of examination are discussed fully. Pneumoperitoneum has fallen out of favor as a roentgenographic procedure due to cardiac and diaphragmatic embarrassments. The lipiodol injection originated by Heuser is stated not to have been attended with the favorable results reported by him in the hands of other workers. The use of gallbladder dye advocated by Albano should be taken "cum grano salis." Unaided roentgenography is the most practical and valuable method at the present time. The general opinion is that fetal structures are visualized with certainty only after the eighteenth week and a negative finding in the roentgen differential diagnosis of pregnancy prior to mid-term must be given with a reservation that pregnancy is not precluded. The fetal age may be estimated within a month or so and may be dated as having reached the ninth month if a center for ossification for the epiphysis of the lower end of the femur is demonstrated. The upper tibial epiphysis will, in five cases out of six, indicate that the child has passed the ninth fetal month, although this may be absent in 25 per cent of full-term children at birth. Determination of fetal position is especially valuable in breech presentations, and serial films will demonstrate the successful accomplishment of version. Amniography is favorably discussed although the author has had no personal experience with the method. The Spalding sign of intra-uterine death of the fetus has been found correct and of value. The diagnosis of congenital syphilis, monsters and pelvic deformities is detailed. With reference to roentgen-ray pelvimetry, its value is emphasized but the author feels that its ultimate scope of usefulness rests upon the answer to the question, "Are the present clinical methods of estimating disporportion entirely satisfactory?" This question should be answered by the obstetrician.—*W. R. Brooksher, Jr.*

GENITOURINARY SYSTEM

McCarthy, Joseph F., and Ritter, J. Sydney. The seminal vesicles; newer instrumental methods in diagnosis and the therapeutic management. *J. Am. M. Ass.*, Feb. 27, 1932, *98*, 687–691.

The precise status of the seminal vesicle as a factor in disease remains to be determined. Catheterization of the ducts is usually possible and should be done in chronic arthritis, vague backache, impotence, and sterility, where other causes have been ruled out and the seminal vesicles are under suspicion. A catheterizing endoscope is described which renders the procedure routinely feasible. With this instrument uncontaminated secretion may be obtained for study, diagnostic vesiculography may be done, and therapeutic lavage be carried out.

The author uses 30 per cent sodium iodide colored with methylene blue, outlining individual saccules and showing dilatation or constrictions of these structures. One case of acute urinary retention had for its cause enormously

dilated seminal vesicles. Congenitally large saccules, congenital defects or arrests, large hypotonic vesicles and chronic inflammations are among the conditions demonstrated in the series of 50 cases.—*E. W. Hall.*

Jeck, Howard S. Horseshoe kidney with especial reference to surgical technic. *J. Am. M. Ass.*, Feb. 20, 1932, *98*, 603–609.

The author studied 26 horeshoe kidneys occurring in 16,735 autopsies at Bellevue Hospital, an incidence of 1 in 643. The average age at death of persons with horseshoe kidney is slightly lower than of normal individuals and these kidneys are more prone to disease than kidneys normally developed.

Preoperative diagnosis is now almost the rule, although before the days of urography it was the exception. Operative procedure is more difficult with horseshoe kidneys and greater precautions are necessary due to the extensive and anomalous blood supply, the possible presence of two ureters on the same side, the size and character of the isthmus, the relative immobility of the kidney and the possibility of rarer anomalies such as fusion of the suprarenals. Care must be taken in case of hemine-phrectomy that the other half of the kidney has a normally functioning ureter. A large extraperitoneal incision is advisable.—*E. W. Hall.*

Joelson, James J., and Zollinger, Robert. Iopax; an analysis of the results obtained in forty-five cases, with report of a case showing a severe reaction following injection of iopax. *J. Am. M. Ass.*, March 5, 1932, *98*, 799–803.

Completely satisfactory pyelograms were obtained in only 40 per cent of the cases and diagnostic pyelograms in only 51 per cent. The dose used was about 25 grams for children and 40 grams for adults. Higher dosage was not employed because of the mild reactions occurring even with this amount and in the series of 45 cases one patient had a very severe reaction lasting sixty hours.

One of the chief deficiencies of the method is the incomplete visualization of the minor calyces, and this renders it rather unsatisfactory for diagnosis of tuberculosis. In pyelitis of childhood, urinary lithiasis, congenital anomalies and nephroptosis it gave best results.

The author feels that while the method of urography by iopax is a valuable addition to our methods of diagnosis in certain cases it will never replace cystography and retrograde pyelography.—*E. W. Hall.*

Morris, Harold L. The demonstration and significance of nephroptosis and urinary stasis. *Radiology*, Jan., 1932, *18*, 56–73.

Each kidney occupies the upper third of the lumbar fossa extending from the upper margin of the twelfth rib to the lower margin of the second lumbar vertebra. The right kidney lies about a finger's breadth lower than the left.

The fixation of the kidney depends on several factors: the fatty capsule through which connective tissue fibers run from the fibrous capsule to Gerota's capsule; Gerota's capsule; pressure exerted by the abdominal viscera; the muscular tone and development of the abdominal viscera; the muscular tone and development of the abdominal walls; the nephrocolic ligament, and the kidney pedicle.

The movable kidney may be described as one which moves with abnormal freedom behind the peritoneum. A long list of symptoms as well as diseases has been attributed to ptosed kidneys, with resultant urinary stasis. By pyeloscopy it can be shown that the normal renal pelvis and ureter undergo very definite rhythmic contractions and dilatations. Many variations of these are observed in the abnormal. Pyeloscopy is but a preliminary procedure to pyelography and is indicated in every case.

Five-tenths cubic centimeter of skiodan is injected through the catheter to locate the tip and its relation to the renal pelvis. After the initial injection 1 c.c. at a time is added until the entire pelvis is clearly outlined; roentgenograms are made, the degree of respiratory excursion of the kidney is noted, and the actual amount of excursion from the prone to the vertical position is observed. Having noted the renal motility in the erect posture, the next problems to decide are: (*a*) Is there any retention or interference with the normal emptying of the renal pelvis while in the erect posture? (*b*) Does the renal pelvis normally contract and relax? (*c*) Is the kidney fixed or rotated so that stasis results? These questions can most satisfactorily be settled only with a table that places the patient in the standing position.—*Ellsworth Johnson.*

SKELETAL SYSTEM

Carp, Louis. The roentgenologic displacements in Colles' fracture, with special refer-

ence to the mechanism of the accompanying fracture of the ulnar styloid: a report of one hundred consecutive cases. *Arch. Surg.*, Jan., 1932, *24*, 1–13.

This study was undertaken to show: (1) the usual roentgenologic displacements in Colles' fracture with an accompanying fracture of the styloid process of the ulna and the practical therapeutic value of such information, and (2) the probable mechanism of fracture of the ulnar styloid.

The frequency of the various types of displacements encountered in 100 consecutive cases is tabulated, with accompanying roentgenograms of representative types. From this part of the study it was concluded that most Colles' fractures accompanied by fractures of the ulnar styloid have sufficient (96 per cent) displacements of the lower radial fragment to warrant reduction in order to obtain the best possible anatomic realinement which is usually essential for the best end-results.

To determine the mechanism of fracture of the ulnar styloid an anatomic study was made of the ligamentous attachments to the ulnar styloid to determine lines of stress and strain with respect to the accompanying fracture of the radius and the other bony structures, a notation was made of the sites of fracture of the styloid process, with their various displacements as shown by the roentgenograms, and the positions and displacements of the lower radial fragment, as shown anatomically and roentgenologically, were correlated. For this purpose the wrist joints of 22 cadavers were dissected to note the ligamentous attachments to the ulnar styloid. The anatomy of the wrist joint with special reference to the ligaments is described and shown in drawings.

From this study it is concluded that the ulnar styloid in Colles' fracture, in the great majority of cases, is fractured at the base by the pull of the intra-articular fibrocartilage of the wrist joint and at the middle and tip by the pull of the ulnar collateral ligament. It is logical to assume that both ligamentous structures may act together to produce fracture of the ulnar styloid, especially when the fracture occurs in two or three places simultaneously. Direct violence probably plays a negligible rôle in any of the fractures of the ulnar styloid, although forceful sudden impact of the carpus against the styloid may be the cause in a very small percentage of the cases.

The article is concluded by quotations from the literature on the mechanism of fracture of the ulnar styloid in Colles' fracture. Most of these were in accord with the conclusions arrived at by the author.—*Karl Kornblum.*

Kraft, Ernest. Melorheostosis Léri: A flowing hyperostosis of a single extremity. *J. Am. M. Ass.*, Feb. 27, 1932, *98*, 705–709.

The disease as described by Léri and Joanny in 1922 is characterized by a hyperplastic bone lesion which involves a single extremity extending from one end to the other in a single track but leaving a few areas normal. Other writers have called the disease "osteosclerosis," "osteosis eburnisans monomelica" and "osteopathia hyperostotica congenita (unius membri)." The pathological change is essentially a proliferation of ivory-like new bone in cortical areas. The morphology of the lesions varies greatly but it confines itself to one side of the bone, and forms a linear track parallel to the long axis. Bony masses form in the soft tissues about the shoulder or hip, and ankylosis may occur.

The first signs of disease appear usually in childhood or adolescence. Pain is present at some stage to a slight degree, though limitation of motion and transient stiffness are chief complaints. The disease is progressive, though never fatal, and has never given evidence of malignant character. The etiologic factor is unknown, various authors ascribing it to vasomotor neurosis, infection, endocrine disturbance, and embryonic defects. A tabular description of 16 cases is given including 2 from the author's practice.—*E. W. Hall.*

Wyatt, Tyree C., and McEachern, Thomas H. Congenital bone dysplasia (osteogenesis imperfecta) associated with lesions of the parathyroid glands. *Am. J. Dis. Child.*, Feb., 1932, *43*, 403–415.

The authors report a case in which there was marked congenital bone dysplasia and unusual vascularity of the parathyroid glands with a relatively small amount of parenchymal tissue. The possibility is suggested that so-called "osteogenesis imperfecta" may sometimes be based in part on a congenital parathyroid disturbance rather than be purely the result of faulty mesoblastic differentiation.

The case reported showed the typical roentgen picture of osteogenesis imperfecta of con-

genital origin. The patient died soon after admission and no complete study of the calcium balance could be made. The normal calcium and phosphorus values in the blood were in accord with those reported in osteogenesis imperfecta. They do not suggest a parathyroid disturbance. However, these bones, Wyatt and McEachern suggest, presumably never had their normal content of calcium salts and this could possibly explain calcium and phosphorus levels in the blood which differ from those of the characteristic parathyroid disturbance of later life.

They had the impression that there was a smaller amount of gland parenchyma in this patient than is usually seen. However, the question can be raised as to the possible influence of such great vascularity on the amount of secretion absorbed into the blood. In view of the conflicting experimental evidence, it would seem that the changes in the bones in this case could have resulted from either decreased or increased parathyroid function during the period of growth. On the other hand, the bone dysplasia and the changes in the parathyroid glands may be purely coincidental. In the case reported by Weber, who suggested a primary lack of mesoblastic development, the osteoid tissue tended to be more abundant and showed less evidence of calcification and thus differed from the case reported by Wyatt and McEachern.—*R. S. Bromer.*

Hunter, Donald, and Turnbull, Hubert M. Hyperparathyroidism: generalized osteitis fibrosa, with observations upon the bones, the parathyroid tumours, and normal parathyroid glands. *Brit. J. Surg.*, Oct., 1931, *19*, 203–284.

MacCallum, Voegtlin, Hanson, Collip, Brehme, György, Reiss, Aub, Hunter et al, have done experimental work showing the effects of parathyroidectomy and administration of parathormone on blood and urinary calcium and phosphorus as well as on blood viscosity. Overdosage with parathyroid extract produces hypercalcemia as shown by experiments with dogs, this hypercalcemia being manifested by loss of appetite, dullness, drowsiness, atonia and failing circulation. Overdosage in men produces hypercalcemia without such marked clinical symptoms.

Von Recklinghausen described generalized osteitis fibrosa in 1891 without apparent knowledge of its etiology. Askanazy described a case in 1904 with parathyroid tumor, the significance of which was unsuspected. Erdheim in 1907 first called attention to the relationship of bone pathology to parathyroid enlargement. Mandl in 1926 first removed a parathyroid tumor for osteitis fibrosa and greatly benefited the patient.

Abstracts of 29 published cases of generalized osteitis fibrosa are presented.

The author presents 4 cases of generalized osteitis fibrosa and hyperparathyroidism, with excellent detailed clinical and pathological reports, which demonstrate the etiologic relationship of the parathyroid to this disease. He also presents 4 cases of focal osteitis fibrosa and one of osteomalacia with blood chemistry, histology and metabolism which seem to prove the absence of hyperparathyroidism in these diseases. Osteomalacia is associated with deficiency in sunlight and vitamins and improves with treatment as a deficiency disease.—*E. W. Hall.*

Bradfield, E. W. C. A case of generalized fibrocystic disease of the bones. *Brit. J. Surg.*, October, 1931, *19*, 192–202.

The case is unusual in regard to the long period of observation, which extended over twenty-three years. At the age of six, cystic areas were shown in both femora, both humeri and the left tibia. No cysts were demonstrated in the skull at that time though it was asymmetrical. The usual repeated fractures brought the patient several times under observation. As an adult he shows marked deformities, markedly cystic bones in which practically all normal structure is blotted out. Microscopic examination of removed tissue showed osteoid tissue imbedded in vascular marrow in varying stages of fibrosis and numerous cartilaginous areas. Interesting roentgenograms and photomicrographs illustrate the report. Laboratory findings throw no definite light on the etiology of the disease. It does not seem to fit into the usual parathyroid syndrome though the possibility of its being a quiescent stage of this condition should be borne in mind.—*E. W. Hall.*

Giles, Roy G. Vertebral anomalies. *Radiology*, Dec., 1931, *17*, 1262–1266.

The importance of these anomalies in relation to actual or alleged injuries is of great in-

terest to all medical men. The name normal variations is suggested in place of congenital anomalies, since these individuals are in a way as normal as those having the standard pattern. In the author's series of 8,000 cases of genito-urinary examinations showing the lumbar spine and pelvis, vertebral anomalies were noted in 1,122 roentgenograms. His findings as to spina bifida, sacralization of the fifth lumbar, hemivertebrae, and anomalies of number and rib attachments are somewhat higher than, but agree well on the whole with, the findings of other workers who are quoted clearly and concisely. The author concludes that employees in hazardous occupations should have the spine roentgenographed routinely when hired and that the determination of direction and amount of force causing an injury is of great help in interpreting confusing roentgenograms.—*E. I. L. Cilley.*

Capener, Norman. Spondylolisthesis. *Brit. J. Surg.*, Jan., 1932, *19*, 374–386.

The author states that slipping of an intact fifth lumbar vertebra is a very rare condition and he devotes the entire article to spondylolisthesis occurring following spondylolysis, meaning the separation of the laminae from the body. Thirty-four cases from the material at the University of Michigan are studied. In many patients, though not all, trauma was the causative factor. The types of injury that produce fracture of the spine may also produce spondylolisthesis. Slipping on only one side produces rotation and scoliosis.

Diagnostic points to observe in the roentgen examination, which includes a good lateral view, are: (1) alinement of the anterior and posterior borders of the vertebral bodies; (2) normal width of the intervertebral disc; (3) shape of intervertebral foramina; (4) continuity of the neural arches; (5) length and relation of spinous arches; (6) evidence of structural bone changes; (7) degree of lumbar curve and angle of the sacrum, and (8) evidences of spontaneous arrest.—*C. L. Martin.*

Reiss, Oscar, and Kato, Katsuji. Gaucher's disease; a clinical study, with special reference to the roentgenography of bones. *Am. J. Dis. Child.*, Feb., 1932, *43*, 365–386.

Gaucher's disease has of late aroused a considerable amount of interest in spite of the comparative rarity of the condition. The authors define it as a familial, chronic, constitutional, non-hereditary disease of metabolism, which is characterized by the deposition of cerebroside kerasin in certain cells of the reticuloendothelial system. Clinically, it shows splenohepatomegaly, without ascites, occasional lymphadenopathy, subicteric pigmentation of the exposed parts of the skin, pinguecula-like thickening of the ocular conjunctiva, hemorrhagic diathesis, unique changes in the bones, a hypochromic type of anemia, slight but early leucopenia, frequent thrombocytopenia and spastic irritative contractions and tremors of a central type. The literature is reviewed by the authors in detail. The morphological characteristics, the chemical contents and the origin of the distinctive cell are described. The so-called large Gaucher cells are peculiar to the disease, contain complex substance in their cytoplasm with eccentrically placed nuclei, and are found in all the organs of the body where the elements of the reticulo-endothelial system are found.

The roentgenologic examination of the bones in Gaucher's disease has furnished a large amount of information as to the nature of the changes in the skeletal system. By this method, one is able in many instances to offer positive data which aid in the ante-mortem diagnosis of the disease. Of all the bones in the body, the femur shows the most typical changes. In the early cases it may be the only bone affected. The change in the lower end, most frequently seen, consists of the presence of areas of rarefaction of varying sizes, which in some cases are intermingled with areas of sclerosis, the so-called "worm-eaten" or "punched-out" picture. The cortex is thin and extremely irregular, especially toward the middle portions of the diaphysis. One or more growth arrest lines may be visible just shaftward to the epiphyseal edge. There is often a very interesting finding of swelling or fullness on each side of the shaft just above the condyles. The swelling may become so marked that the normal contour of the femur at its distal end, with a concave flaring of the condyles, may be transformed into the shape of an Erlenmeyer flask or may resemble a club shape. When correlated with other findings this may be regarded as a diagnostic sign of the disease.

In the authors' cases the hip joint signs were outstanding items in the history. Roentgenologic examinations revealed osteoporosis with

extensive areas of rarefaction, mingled with those of condensation. Pathologic fractures through the neck of the femur were also found, with angulation of the fragments, causing a coxa vara appearance. This latter change may even appear in the absence of fracture. The head of the femur sometimes is flattened, resembling the deformity of Perthes' disease, chronic osteomyelitis or tuberculous coxitis. The portion just below the neck often showed a mottled appearance, owing to juxtaposed areas of rarefaction and condensation, with irregularities in the thickness of the cortex.

The same changes are seen in all the other long bones, especially the humerus, tibia, radius, ulna, and ribs. The pelvis is also frequently involved.

Reiss and Katsuji had no cases in which the vertebrae were involved. When any portion of the spinal column is affected, there is usually produced a compression fracture of the spine due to gibbus formation. The Gaucher cells are present in nearly all of the bones of the column, but the actual deformity and compression fracture may be limited in number. Pick has emphasized the fact that the intervetebral discs are usually intact, in spite of the extreme degree of bone destruction, a point that differentiates the condition from tuberculous spondylitis.

One case of involvement of the skull bones has been reported, that of Pick. Here the calvarium was affected, the diploë being filled with a Gaucher cell mass, and the inner surfaces of the parietal bones contained symmetrically placed yellowish spots of these cell nests.

On section of the affected bones, numerous small, thick, whitish areas, arranged in a stellate form, either in nodes or in streaks, or sometimes in a net-like manner, are found. These areas contain the large typical cells, which for the most part retain the same shape found in other organs of the lymphatic-hematopoietic system, but where they are compressed between unyielding walls, as between the trabeculae of spongiosa, they may assume an elongated and spindle form, often resembling the fibers of smooth muscle. These masses of Gaucher cells may be intermingled with lymphoid cells, and in hematopoietic tissues of the myeloid areas they are intimately mixed with red blood cells. When the disease is long continued, the accumulation of Gaucher cells and the consequent pressure on the surrounding tissues may cause necrosis of the spongiosa, leading to rarefaction and irregular lining of the cortex. When such necrosis occurs near the epiphysis, pathological fractures may occur, The intervertebral discs never become deformed, although they may be filled with Gaucher cells and hold the deformed vertebrae in their substance.

Splenectomy is the only method of treatment. Surgical intervention, however, gives only temporary relief and has no value as a cure for the disease.—*R. S. Bromer.*

Girdlestone, G. R. The pathology and treatment of tuberculosis of the knee-joint. *Brit. J. Surg.*, Jan., 1932, *19*, 488–507.

Tuberculosis of the knee may be divided into three groups on points elicited from stereoscopic roentgenograms. They are: (1) the extra-articular type having purely extra-articular foci; (2) the focal-articular type with bone foci communicating with the joint, and (3) the non-focal type in which no foci can be seen in the roentgenograms. Treatment can be administered on the basis of three age groups divided as follows: (1) young children from 0–10 years for whom prolonged immobilization is indicated, but neither diagnostic arthrotomy nor fusion; (2) adolescents and adults, 15–50 years, for whom immobilization is preparatory to confirmation of diagnosis by arthrotomy, followed by fusion, and (3) the elderly from 50 years onwards for many of whom amputation is wiser than fusion.

Emphasis is laid on the fact that treatment should be started in children as soon as the clinical signs appear, and not after roentgenographic evidence of bone and cartilage is obtained if functioning joints are to result. Diagnostic arthrotomy is condemned except in older patients where fusion is to follow. A large portion of the article deals with treatment, and operative procedures are discussed in detail.—*C. L. Martin.*

Leriche, René, and Fontaine, René. De la valeur thérapeutique des infiltrations périarticulaire à la novocaïne dans les entorses et les arthrites traumatiques. (The therapeutic value of periarticular injections of novocaine in sprains and traumatic arthritis.) *Presse méd.*, Feb. 20, 1932, *40*, 280–282.

The authors recommend the periarticular in-

jection of novocaine for the treatment of sprains and traumatic arthritis. The term "traumatic arthritis" is reserved for the designation of prolonged functional disturbances which are always associated with pain and occur after articular traumatism without fracture and in which, even in the advanced stages, no other anatomic findings can be demonstrated than a slight osteoporosis of the articulations involved. If left alone some of the patients afflicted with this condition may recover spontaneously, but the majority will develop a more or less permanent functional disability. The novocaine is injected periarticularly in the amount of 10 to 25 c.c. of a 1 per cent solution (without adrenalin), the injections being made every day or every other day until healing is obtained. Three cases representing typical examples are described in detail and illustrated with photographs and roentgenograms. The method is entirely harmless. It must be mentioned, however, that only the acute cases are amenable to permanent healing, whereas in the chronic cases an improvement is all that can be expected.—*T. Leucutia.*

BLOOD AND LYMPH SYSTEM

EMPEY, LUCAS W., and PROESCHER, FREDERICK. Agranulocytosis; report of a case, with autopsy observations. *Am. J. Dis. Child.*, April, 1932, *43*, 947–972.

The authors report a case of primary, idiopathic agranulocytosis in a child, aged three and one-half years. The case history is given with attention to detail. Their study of the case supports the view that the disease is caused by an unorganized noxious agent that acts on the bone marrow. They support this theory by the fact that no evidence of a focal infection could be demonstrated clinically, previous to the time the granulocyte count fell so low as seriously to impair the body's defense against saprophytic organisms; by the type of necrosis that was found pathologically; by the fact that a blood culture was negative during an afebrile remission of the disease, even though the granulocyte count was gradually falling.

The only noxious agent that they could find in this case was exposure to the fumes given off by the flue of a gas-burning furnace in the home for a period of three weeks at least. This exposure occurred more than twelve months prior to the appearance of the first symptoms attributable to the disease. They suggest more careful inquiry in cases in the future into possible exposure to such gases.

The treatment of their case consisted in leucocytic extract in large doses, a daily injection of 5 per cent nucleinic acid, stimulation of the long bones with small doses of roentgen rays, injections of whole pituitary solution (Armour), autogenous vaccine, blood transfusions and oral hygiene with perborate mouth washes. In addition the patient was given one vial of liver extract and two dessert spoonfuls of codliver oil daily. The diet was purposely low in fat. Blood transfusion and oral hygiene were the only therapeutic measures that seemed to be of value.—*J. C. Rosen.*

BATY, JAMES M., BLACKFAN, KENNETH D., and DIAMOND, LOUIS K. Blood studies in infants and children. I. Erythroblastic anemia; a clinical and pathologic study. *Am. J. Dis. Child.*, March, 1932, *43*, 667–704.

This is a very complete study of erythroblastic anemia. The article consists of an introduction; a review of the literature; clinical and pathologic aspects, including age, incidence, symptoms, physical findings, roentgen findings, hematological data, hematological data following splenectomy, other laboratory data; pathology including the bone marrow and bone, spleen, liver and lymph glands; the course and prognosis, differential diagnosis, and treatment. These sections are followed by comment on the cases reported, a summary and a complete report of 20 cases.

To cover all of these sections in an abstract is impossible because of lack of space. The article should be read in order to grasp its complete description and discussion of the disease. The authors state that the roentgen findings are constant and characteristic. They vary in degree in different patients and in different bones of the same patient, with a tendency to become more marked as the disease progresses.

The long bones show unusually prominent medullary trabeculations, especially at the metaphyseal ends of the diaphyses. This is most marked in the small bones, the metacarpals and metatarsals, because of the better detail obtained in the roentgen films. The changes can be recognized here most easily and in the earliest stages. The total width of the bone is definitely increased, owing to the widening of the medullary portion, which shows rarefaction and increased trabeculation. The corti-

cal portion, however, is markedly thinned and occasionally presents punched out areas. When the process is more advanced and the cortex is exceedingly thin, pathologic fractures may occur.

The cranial vault, in the early stages of the disease or in milder cases, shows only a slight thickening and an increased porosity of all bones with thinning of the tables. In the advanced stages, the depth of the bony structure becomes so thin and porous that it cannot be detected as a distinct plane. The diploë is very prominent and seems to extend beyond the outer table. The profile view of the skull then gives the appearance of a surface studded with small radiating spicules perpendicular to the tables of the skull. The fuzzy outline is described best by the phrase "hair standing on end." The rest of the skull plate has fine spongy appearance.

There are irregular trabeculations, increased porosity and radiability in the bones of the pelvis, the vertebrae, the ribs, the clavicles and the scapulae.

In the authors' summary the disease is defined as a disease entity of unknown etiology characterized by a racial, congenital and often a familial incidence, enlargement of the spleen and to a lesser degree of the liver and peripheral lymph nodes, a slowly progressing anemia accompanied by large numbers of nucleated erythrocytes in the peripheral blood, peculiar changes in the bones, a characteristic facial appearance and, histologically, erythropoietic hyperplasia of the bone marrow and extensive erythropoiesis in the spleen.—*R. S. Bromer.*

Vasiliu, Titu. Conceptions étiologiques et pathogéniques, de la lymphogranulomatose, tirées de son étude expérimentale. (Etiologic and pathogenic conceptions of lymphogranulomatosis as drawn from its experimental study.)

Favre, and Croizat, P. Caractéristiques générales du granulome malin tirées de son étude anatomo-clinique. (General characteristics of malignant granuloma as drawn from its anatomo-clinical study.) *Presse méd.*, Jan. 6, 1932, *40*, 25–27.

These two articles represent reports which are part of a symposium on lymphogranulomatosis as presented before the third full session of the Anatomic Society of France. The first concludes with the assertion that the tuberculous nature of lymphogranulomatosis cannot be completely rejected but that, on the other hand, bacteriologic and experimental investigations have not brought sufficient proof as yet of the existence of another type of pathologic germ. The second states that lymphogranuloma, despite its many variations, represents a definite entity both from the histologic and clinical standpoint which must not be, because of the many atypical forms, confused with the diffuse group of reticulo-endothelioses of various origins.

Sluys in discussing the value of roentgen therapy expresses the opinion that the fractionated roentgen therapy applied only for the manifest lesions should be replaced by total irradiation over large fields with small frequently repeated doses, or, still better, by a general irradiation of the entire body at great distance (teleroentgen therapy).—*T. Leucutia.*

Cooley, Thomas B., and Lee, Pearl. Erythroblastic anemia. *Am. J. Dis. Child.*, March, 1932, *43*, 705–708.

The authors state that further experience with erythroblastic anemia has strengthened their conviction that it is a clinical entity. In reviewing the series of cases originally reported by Cooley, they have now determined that all of the proved cases occurred in Greeks or Italians, and Sicilians. They are not inclined to lay great stress on the limitation of this or any other similar disease to a particular race, as it seems likely that any disease in which there is a hereditary element is limited more by locality and association than by race. The first case is probably a "sport" and the spread from it naturally occurs first in the same locality and among people of the same race. If a similar "sport" occurs in another locality and in another race, a second focus may arise.

The red cell in this anemia is a very large cell with a markedly uneven distribution of hemoglobin. It is a morphologic giant which is not functional because of a defective supply of hemoglobin. It has also an abnormal stroma. Some microcytes in contradistinction to this macrocyte are found also. The only anemia of childhood presenting a similar picture is sickle cell anemia. In this disease the cell is not usually so large, but it shows the same uneven distribution of hemoglobin. It also gives the same results with the stroma stain.

Normoblasts in large numbers and a moderate number of megaloblasts are observed almost invariably. Reticulocytes are usually present in a considerable proportion, from 10 to as high as 30 per cent. Leucocytosis is almost constant and at times of high degree. The type of cell varies and is not characteristic. At times two of the patients of the authors' series have had an aplastic picture with leucopenia and scarcity of polymorphonuclears and platelets.

Their patients showed, on the whole, a higher degree of serum pigmentation than those of the series reported previously from Boston, the index being from 8 to 30 or even higher, though periods occurred when it fell to normal. With one exception, in which the findings were normal, all their patients have shown an increased resistance in tests for fragility. In regard to pathologic findings they have nothing new to report since their earlier case reports and those reported by the Boston group. They have come to believe that splenectomy, in addition to relieving the child of the burden of the enormous spleen, may retard the progress of the disease. While hemolysis is a constant and important feature, they are no longer inclined to believe that the disease is primarily a hemolytic disorder in the sense that hemolytic icterus is. The apparent relationship is greater to pernicious anemia and sickle cell anemia, and it seems to them probable that the urge to put forth quantities of immature cells and the resultant hyperplasia of erythropoietic tissue may be the result of some metabolic disturbance which compels these tissues to make "bricks without straw."—*R. S. Bromer.*

GENERAL

Rhinehart, D. A. Air and gas in the soft tissues: A radiologic study. *Radiology*, Dec., 1931, *17*, 1158–1169.

The shadows of gas in the soft tissues is of great importance in many types of injuries. It may be carried in by the traumatizing agent or introduced with irrigating agents such as peroxide of hydrogen. Introduced air is of little importance clinically and will usually be absorbed in from ten to twelve hours. Gas in the roentgenogram is the first positive sign of gas infection. In a series of cases at the Little Rock Hospital the diagnosis of gas infection was made clinically an average of fifty hours, and by roentgen ray an average of nineteen hours after injury. If the gas is of infectious origin it will show definite increase in amount after six hours. Introduced air will show no advance. The type of gas infection cannot be determined by the roentgen ray alone; however it is of great importance in determining the extent of the infection as well as in directing operative procedures.—*E. I. L. Cilley.*